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CHINA REPORT

SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

FANG YI SPEAKS ON SCIENCE, TECHNOLOGY LAWS

OW271438 Beijing XINHUA in English 1431 GMT 27 Aug 85

[Text] Beijing, August 27 (XINHUA)--Fang Yi, member of the Political
Bureau of the Chinese Communist Party Central Committee, called on scientists
and lawyers to closely cooperate in promoting legislative work in science
and technology.

Addressing the closing session of the National Forum on Legislative Work
in Science and Technology, Fang said such cooperation was of great importance
to the development of science and technology in China and the building of
a socialist legal system.

In a letter to the forum, Peng Zhen, chairman of the Standing Committee
of the National People's Congress, said he hoped the meeting would system-
atically sum up China's experiences in this field and also learn from
other countries.

Peng Chong, vice-chairman of the Standing Committee of the National People's
Congress said that legislative work in science and technology was a weak
link in the country and convening of the forum was a good beginning in the
field. Legislation should keep abreast of the country's reforms in manage-
ment of science and technology and ensure the smooth process of the reforms.

He said in the past five years China had worked out about 30 laws and
regulations and efforts to strengthen legal work should continue. He hoped
publicity about the legal system would be broadened in order to help everyone
observe the laws and regulations.

Zhou Gucheng, vice-chairman of the National People's Congress Standing
Committee, also spoke at the meeting.

The forum, which opened here on August 21, was attended by 160 scientists
and lawyers from across the country. They discussed legislation concerning
science and a draft law on technical contracts.

CSO: 4010/2015

NATIONAL DEVELOPMENTS

SHANGHAI'S JIANG ZEMIN AT CITY SCIENCE CONFERENCE

OW081218 Shanghai City Service in Mandarin 0100 GMT 5 Sep 85

[Text] The municipal government held a conference on science and technology work at the Shanghai Exhibition center yesterday. The purpose of the meeting was to implement the decision of the CPC Central Committee on reform of the scientific and technological structure and mobilize the municipality's 370,000 scientists and technicians to allow them to plunge themselves into the powerful current of the drive to rebuild and invigorate Shanghai, strive to pursue scientific and technological research, and join the rest of the people in Shanghai in the struggle to implement the strategy for Shanghai's economic development.

Present in the conference were Jiang Zemin, Huang Ju, Wu Bangguo, Chen Tiedi, Sun Guizhang, Zhang Dinghong, Zeng Qinghong, Zhu Zongbao, Lin Zhenyuan, Ye Gongqi, Xie Lijuan, Tan Jiazhen, Yang Shifa and Xu Yifang, leading comrades of the Municipal CPC Committee, Municipal Government, Municipal's people's Congress Standing Committee and municipal CPPCC Committee; and (Wu Zhaosen), member of the party group of the State Scientific and Technological Commission.

Before the conference opened, the leading comrades met with the 22 scientists and technicians who have made outstanding contributions in scientific and technological work.

Vice Mayor Liu Zhenyuan made a report to the conference. He expounded on the historical mission of all scientists and technicians in Shanghai, the strategic key points of scientific and technological work and the need to implement scientific and technological structural reform in an all-round way. Liu Zhenyuan said that in order to implement the strategy for Shanghai's economic development, the strategic emphasis of scientific and technological work should be placed on the following areas: the development of new technologies; the establishment of new and developing industries; the acceleration of the process of digesting and absorbing imported technologies; the implementation of technological renovations in key industries; the active development of those advanced and suitable technologies that require relatively small investments and can be put to use in a short period of time; and the use of advanced science and technologies for urban construction and management.

In a summary speech, Mayor Jiang Zemin elaborated on these points: scientists and technicians should have lofty ideals; it is necessary to have a complete and dialectical understanding of the relationship between science and technology and economic construction and correctly handle the relationship between importing technologies and relying on our own efforts; the training of competent personnel is the key to technological advances; and it is necessary to make further efforts to implement the party's policy toward intellectuals.

CSO: 4008/2032

NATIONAL DEVELOPMENTS

RENMIN RIBAO STRESSES NEED FOR S&T PROGRESS

HK260910 Beijing RENMIN RIBAO Overseas Edition in Chinese 19 Aug 85 p 2

[Article by Lin Zongtang [2651 1350 2768]: "Technical Transformation Must Depend on Scientific and Technological Progress"--passage within scantline published in boldface]

[Text] In the "Report on the Sixth 5-year Plan," Comrade Zhao Ziyang emphatically pointed out: "Economic vitalization must depend on scientific and technological progress while scientific and technical work must be geared to economic construction. This is a matter of fundamental principle." Acceleration of technical transformation in existing enterprises is an important strategic principle in realizing economic vitalization. Therefore, technical transformation must also depend on scientific and technological progress, while scientific and technical work must be also geared to technical transformation.

The aim of accelerating the technical transformation of existing enterprises is to better develop social productive forces at a faster speed. The key to the four modernizations lies in the modernization of science and technology. This is not just a theoretical matter. It is a very important, realistic issue for our daily lives, a major issue concerning our prospects for economic construction of the whole country, as well as the success or failure of the great cause of the four modernizations. It is an extremely pressing task.

Our general task is to realize the four modernizations of socialism. If we work with all our might for 20 years but our technology remains outdated and backward, and the technology gap between our country and the advanced countries of the world becomes wider and wider, it will not be modernization, even though the annual gross value of our industrial and agricultural output is quadrupled. Moreover, if our technology cannot be updated, production will in no way develop. Quadruplication will become a hollow word. Socialist production development must be gradually shifted from the original old technologies, techniques, equipment, and products on to an entirely new basis. Only by so doing can we constantly raise our economic efficiency and gradually narrow the gap between our country and the advanced countries in the world in terms of economy and technology. How do we accomplish this shift? Certainly, it is necessary to build a number of new factories with

the help of new technology. But, it is more important to carry out the technical transformation of existing enterprises by means of new technology. Therefore, production development must be gradually shifted from the original, old technology to new technology through the technical transformation of old enterprises, rather than through "duplicating antiques and freezing technologies." But, this must depend on the progress of our science and technology.

The scale of existing industrial enterprises in our country has become rather large. However, as a result of overlooking technological progress, technical transformation, and business management for such a long time, there is a wide gap between our country and the advanced levels of the world. This is bad, but it also shows that the latent potential of existing enterprises in our countries is very great. From 1950 to 1981, our country's total industrial and agricultural output value in 1981 was also 750 billion yuan. With 1 yuan investment only producing 1 yuan output value, we have lagged far behind the technically-advanced countries in the world. From 1952 to 1981, our country's total investment in the engineering industry was 65 billion yuan. Generally speaking, our country is still backward in science and technology. Therefore, the fundamental method of enhancing economic effectiveness still lies in the progress of our science and technology. In the coming 20 years, if we can firmly grasp the two key links of accelerating the technical transformation of existing enterprises and improving their business management to actively facilitate the scientific and technological progress of factories and enterprises, try in every possible way to tap the latent potential of existing enterprises and raise the present "investment and output value ratio" of 1:1 to 1:2, and 1:3, our total production output value could double or triple. In addition to some necessary key construction projects, it will be entirely possible for us to accomplish the task of "quadrupling the annual gross value of the industrial and agricultural output" as set by the Party.

In reviewing the history of industrial and technological development in the world, we learn that a country which could transform its industrial technology from being backward to advanced will generally follow three patterns: First, "sowing," which means relying solely on one's own strength to develop; second, "transplanting," which means importing whole sets of equipment or technology from abroad; third, "grafting," which means introducing some key technology on the basis of its own technology. Each of these three patterns has its own characteristics and can be integrated with each other. How we apply these patterns to achieve the best results is a question of strategic principle with realistic significance.

Primarily relying on our own strength to realize our aims, the "sowing" pattern is a very important method of self-reliance and should be followed by us, not only in the past as we did, but also now and in the future. Our country succeeded in manufacturing its first atomic bomb in 1964, detonating our first hydrogen bomb in 1967, launching our first man-made earth satellite

in 1980, projecting a long-range carrier rocket to the South Pacific maritime space in 1980, discharging a carrier rocket from under the water in 1982, and manufacturing, launching and positioning an experimental synchronous communications satellite in 1984. All these breakthroughs in the high technology of national defense have proved that we are able to break through any technical barrier and scale new heights in science and technology by relying on our own strength.

In manufacturing complete sets of important equipment, we have also acquired much useful knowledge. While manufacturing the atomic bomb, we also succeeded in manufacturing a 12,000-ton hydraulic press. In the 1960's, we succeeded in developing nine types of important metallurgical equipment. In the 1970's, we succeeded in building up the No 2 motor vehicles factory. In the early days of the 1980's, we again succeeded in completing the key Gezhouba water-control project. In the past, material and technical conditions were very poor, but we still could design and manufacture by ourselves complete sets of important equipment; at present, the material and technical conditions are much better than before and the whole party's focal point of work has shifted toward economic construction. We are now more confident of modernizing the motherland by relying on our own strength.

Previously, blockaded and contained by foreign countries, we were forced to take the "sowing" pattern. But now, when the policy of opening up to the outside world has been adopted, should we continue to follow this "sowing" pattern? We should make a concrete analysis of this question. If introducing items from abroad is advantageous to us, we should not start from the very beginning of "sowing." However, if we cannot introduce these items from abroad, or these items are not advantageous to us though they can be introduced, we should still follow the "sowing" pattern. Nevertheless, its content and pattern should be correspondingly improved and developed.

First, judged by technological levels, foreign capitalists will not sell their really advanced technology to us. At best, they will sell us some second-class or third-class goods, but very often they just let us know the hows, not the whys. In order to scale the summit of technology, we must still strive to strengthen our own research and development capability.

Second, judged by variety and quantity, for example, the engineering industry of our country now has only tens of thousands of products; it will need hundreds of thousands of products in the future. Even though we are now able to introduce tens of thousands of products, this is only a small amount. We must still develop many more. Therefore, it is not realistic for us to wait for everything to be introduced from abroad.

In fact, the "sowing" pattern should not be rejected. Instead, we should pay special attention to absorbing the advanced technologies of foreign countries, selecting the useful varieties in the world and making them

serve us. Equipment developed by us has been manufactured by relying on and studying and absorbing the advanced technologies of foreign countries. We should be familiar with both our strong and weak points, and be good at studying the advanced technologies of others. By drawing on the strong points of others to make up for our weak points, we can reduce the time spent on starting from the very beginning. Standing on the shoulders of "giants" to step up research and development and striving for the advanced levels in the world is the true self-reliance we need.

It is completely necessary for a country to follow the pattern of "transplating" to introduce some complete sets of equipment and technology from abroad when its industry begins to develop. We have had past successes in introducing complete sets of equipment but there is room for improvement. When introducing some complete sets of important equipment, we did not, at the same time, introduce corresponding technology. Therefore, though such equipment was introduced one set after the other, we still could not design and manufacture them ourselves. Because spare parts and fittings depended on foreign countries, maintaining long-term production became a headache.

More important, permanent dependence on foreign countries for complete sets of important equipment will bring unfavorable consequences for our country's economic construction. On the one hand, the state has to spend double, even redoubled, money to purchase complete sets of equipment from abroad; on the other hand, this prevents our domestic engineering industry from developing and its technological level from improving. A vicious cycle is thus formed: Since the quality of our own complete sets of equipment is not high, construction units prefer to import such equipment from foreign countries. The domestic engineering industry thus does not have the opportunity to practice and improve, and the gap between our country and foreign countries becomes wider and wider. Construction units then try even harder to import complete sets of equipment. If this vicious cycle continues, we will never be able to master the key technology of such equipment. How can we then establish a technical foundation for our economic vitalization in the coming 10 years?

We once designed and manufactured by ourselves some complete sets of important equipment. While some products have been "attentively studied" and "perfected" for many years, their quality is still unsatisfactory and it is not trusted by customers. In order to lessen the amount of time we spend fumbling in the dark, some complete sets of technology should be introduced from abroad. These will help us in our attempt to catch up, improve upon, and transform international standards. We should resolutely take the road of "introducing, assimilating, developing and creating," and manage to achieve an advanced starting point, a fast pace, and good results.

In order to raise the technical level of our domestic industry, it is still necessary to actively follow the pattern of "grafting" to introduce advanced technology on the basis of our own technology. Compared with

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introducing complete sets of equipment, introducing technology has some marked advantages: 1) It helps us in training and improving upon our country's own technical forces. Technical personnel who once tempered themselves develop a better capability of meeting emergencies. 2) In terms of our national situation, it helps us rely on domestic raw materials and fuel. We can adapt foreign technologies to local conditions and let them take root in our country. 3) It helps us use our own hands to transform and manufacture equipment and build factories with Chinese characteristics. 4) It helps us solve the problem of spare parts and fittings and equipment maintenance. 5) It encourages us to study the management thoughts and experiences of our counterparts. 6) While contracts exist, we can constantly absorb the other side's newly developed technologies, so as to constantly narrow the gap between our country and the world. 7) It is much cheaper to import technology than equipment, and it's economically more efficient. 8) We can learn everything from one and produce a chain reaction, so as to raise the technical level of an entire trade. In brief, introducing technology from abroad is conducive to strengthening our country's self-reliance capability and should be actively and boldly promoted.

In short, technical transformation must depend on technical progress. We must pay close attention to "depending on." As for which pattern is the most effective, economical, and advantageous, we should make a detailed analysis of the concrete conditions of each item and product and deal with them in different ways. We should encourage people to be like the eight immortals soaring over the ocean, with each of them showing his true worth. We must guard against "seeking uniformity."

CSO: 4008/2032

STATE S&T COMMISSION DECIDES ON DIRECTION OF REFORM

Tianjin JISHU SHICHANG [TECHNOLOGY MARKET] in Chinese 25 Jun 85 p 1

[Article by staff reporter: "The State Science and Technology Commission [SSTC] Issues a Circular on Eight Lines of Distinction for Determining the Direction of Reform and Against Unhealthy Tendencies"]

[Text] Recently, the SSTC issued a circular drawing distinctive policy lines to ensure the smooth progress of the reform of our S&T system.

The circular points out that following the publication of the "Resolution of the CPC Central Committee on the Reform of the S&T System," a new situation has arisen on the nationwide S&T reform front. In this new situation, new conditions and new problems have arisen, in addition to which we also encounter the problem of a lack of experiences as well as the problem of deficiencies in our legislation, and also the incidence of unhealthy tendencies. In observance of the directives of the Central Committee and the State Council, we must firmly maintain the direction of the reform, draw distinctive lines of policy and oppose newly arising unhealthy tendencies, in order to promote the smooth progress of the reform of our S&T system.

First, we must draw clear lines of distinction between, on the one hand, scientific research units implementing the "Suggestions on Developing a Reform Experiment of Changing Research Units From an All-Paid Operating Expenses to a System of Remunerative Contracts," and the "Certain Suggestions on Readjusting the Present Natural Sciences Research Organizations," both having been approved by the State Council, and, furthermore, implementing the "Provisional Regulations on the Transfer of Technologies," promulgated by the State Council, by carrying out experimental reforms and granting well-deserved promotions in rank, incentive rewards, floating wages, etc., and, on the other hand, the abrupt preferential promotion of cadres, indiscriminate issuing of bonuses and the arbitrary raising of wages. We must resolutely implement the Central Committee's reform resolution, continue to implement the provisions in the relevant documents approved and issued by the State Council and effectively carry out the reform of our S&T system.

Second, we must draw clear lines of distinction between, on the one hand, the granting of incentive rewards to S&T personnel who have made contributions, the granting of substantial rewards to those who have made important

contributions, and, on the one hand, the concoction of pretexts and indiscriminate issuing of bonuses. We must conscientiously implement the principle of distribution according to work, larger gains for more work, and must resolutely to overcome "egalitarianism."

Third, we must draw clear lines of distinction between, on the one hand, the receipt of reasonable remuneration gained from appropriate concurrent positions or after-hours intellectual work by S&T personnel, provided it does not interfere with their main work or the technical or economic interests of the units of their principal employment, and, on the other hand, those cases where people unscrupulously neglect their principal work to seek personal profits elsewhere. We shall permit S&T personnel to take on proper concurrent work or after-hours intellectual work, so that the potential that we have in our S&T personnel is fully brought into play.

Fourth, we must draw clear lines of distinction between, on the one hand, S&T personnel with the approval of their principal employers being kept on the roster of their principal employers without pay, either being employed for technical developments in other enterprises or villages, or undertaking contractual work of a technical nature and receiving a reasonable remuneration, and, on the other hand, those cases where someone leaves without proper resignation in order to seek, without any scruples, to make a profit elsewhere. We must support and encourage S&T personnel to engage in activities that are beneficial for the integration of S&T with economic factors.

Fifth, we must draw clear lines of distinction between, on the one hand, enterprises in remote border regions or villages and medium- and small-sized enterprises openly inviting S&T personnel in enterprises where relatively large concentrations of such personnel are employed for an insufficient volume of tasks to apply for positions offering comparatively favorable work and living conditions, and, on the other hand, those cases where improper methods are used, cutting the ground from under someone else's feet, and directing the flow of S&T personnel into irrational directions. We must permit the rational movement of S&T personnel, so as to change gradually the irrational distribution of S&T personnel that prevails currently.

Sixth, we must draw clear lines of distinction between, on the one hand, scientific research units and S&T personnel opening up markets for technologies and engaging in the trading of technologies in a variety of forms, and, on the other hand, party and government organs or party and government cadres engaging in business and running enterprises, seeking to gain private advantages by relying on the powers of their offices. We must in every way open up markets for technologies and promote rendering technologies into commodities.

Eighth, we must draw clear lines of distinction between, on the one hand, scientific research units gaining rational incomes through technology contracts or through the sale of new products, while making sure that most of it will be used for further S&T developments, also to improve the work and living conditions of the S&T personnel, and, on the other hand, cases of disguised, illegal distributions in breach of financial and economic

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discipline, merely to gain personal profits. To the extent possible, we must solve certain real difficulties of the S&T personnel in a realistic and thorough manner.

Correctly drawing distinctive lines of policy, eliminating all unnecessary apprehensions among scientific research units and S&T personnel, courageously proceeding with our reform and promoting the healthy progress of the reform of our S&T system are all extremely important and necessary actions. It is our principle that the reform of the S&T system be executed unswervingly and that the newly arising unhealthy tendencies be resolutely rectified.

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CSO: 4008/2025

NATIONAL DEVELOPMENTS

S&T UNIVERSITY TRAINS CHILD PRODIGIES

Beijing RENMIN RIBAO [OVERSEAS EDITION] in Chinese 6 Jul 85 p 1

[Article by staff reporter: "S&T University Effectively Trains Child Prodigies; Up to 100 Extraordinarily Gifted Youths Graduate On Completion of Their Studies"]

[Text] The preparatory course for early youths at the Jingshan School in Beijing, commissioned by the China S&T University, recently decided to enroll 17 extraordinarily gifted youths for advanced courses of study. From January on, admission notices were sent out to various places throughout the country. This is a group of "quasi-child prodigies," enrolled after the strict testing of over 100 top youngsters below the age of 13, recommended by the various provinces and municipalities of the entire country. Similar selections are now also taking place at the Suzhou Middle School in Jiangsu Province. Xin Houwen [6580 0624 2429], vice president of the S&T University said: "The early development of talents and the development of outstanding talents of high caliber is the objective of operating these preparatory classes."

Since the inception of such classes for youths in 1978, the China S&T University has run 8 terms with a total enrollment of 278 students in these classes. The youngest student was only 11 years old and the oldest 16 years old. In the current class, 117 students graduated, of whom 81 qualified for graduate studies for master or doctoral degrees in China and abroad.

Among China's population of 1 billion, the number of extraordinarily gifted youths is considerable; they make up 3 per thousand of the total population.

Most children entering the classes for youths show excellent results, are eager to learn, are very alert and have enquiring minds. The level of their knowledge is not below that of ordinary university students. Nine students of the 1981 class for youths of the S&T University sat for the examination for admission to graduate school 2 years ahead of the usual time, and seven of them were accepted, of whom five became graduate students for study abroad. In 1982, 47 students sat for the examination for admission to graduate school 1 or 2 years ahead of usual time, of whom 38 were admitted as graduate students in China and abroad; this was an admission ratio of 81 percent.

The students of the China S&T University's classes for youths are first recommended by various localities, then they have to pass the national science and engineering college entry examination and have their examination papers evaluated by the S&T University according to the evaluation standards of the Ministry of Education, whereupon the best will be selected as finalists. These will then be subjected to another test to determine the final candidates; their admission standards are indeed not below the grade point lines fixed for the ordinary students of that discipline. The prospective students for admission are students from junior middle schools or from the first grade of senior middle schools under 15 years of age, but they are required to have a good general education of senior middle school level.

The students in the classes for youths have a great receptive capacity; the teachers of the various subjects must face this reality and appropriately increase the degree of difficulty, determine a singular training plan for top-flight students and also allow the students to stay away from courses that teach subjects which they already master. Of course, these university students are very young and are still in the psychological state of children of their age. Their teachers should organize games for them between classes and also pay painstaking attention and care to their manner of living.

The first time professor Li Zhengdao [2621 2398 6670] inspected the S&T University, the students of the youth class appeared very reserved and withdrawn, not daring to raise any questions. On his second visit, however, the youths appeared very animated; they not only dared raise questions, but also engaged in a lively discussion with professor Li Zhengdao on some of the questions. Professor Li Zhengdao was very pleased and selected three of the youths as graduate students.

Practice has proved that under the guidance of top-ranking Chinese or foreign scholars, China is able to bring forth at a very fast rate a number of extremely young Ph.D's.

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CSO: 4008/2025

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NATIONAL DEVELOPMENTS

COMMENTATOR ENCOURAGES COOPERATION BETWEEN RESEARCH, PRODUCTION

HK231427 Beijing QUANGMING RIBAO in Chinese 9 Aug 85 p 1

[Commentator's Article: "Make Considerable Headway in Research-Production Cooperatives"]

[Text] In order to meet the needs of the reform of the economic structure and the reform of the science and technology system, large numbers of research-production cooperatives have emerged in China in recent years. This is a good way to develop technological and economic coordination. It is one of our pressing tasks to further develop such cooperatives so that they can play a greater role in the building of the four modernizations.

With promoting production and attaining better economic results as the target and mutual benefit as the lever, the research-production cooperatives are the loose technological and economic link between several economic bodies and research institutes that have not changed their administrative relations.

Although the history of research-production cooperatives is relatively short, they have manifested their great vitality. The cooperatives have the following characteristics. They can bring about favorable conditions, a fast pace, and better results, and push science and technology forward. As a cooperative organically combines research, design, trial production, and production into an integrated body and coordinates the production capacity with the tackling of key problems, it can gain greater advantages. In accordance with the needs of production and the market, a cooperative makes research and production a coordinated process. In light of the circumstances of an enterprise, the research institute tackles key technological problems, while the enterprise provides conditions for experiments and makes preparations for applying the research findings to production, thus accelerating the transfer of the research findings from the laboratories to factories and markedly raising the application rate of the research findings. As a cooperative can tackle key problems and make the most of its production capacity, it can achieve certain economic results within a relatively short period. With a cooperative, the technological experience and conditions for manufacturing a production prototype and conducting industrial experiments offered by the enterprise to the research institute can improve the research level of the research institute as well as enhance the technology exploitation capability of the enterprise.

The work to be done at present is to earnestly strengthen leadership, vigorously conduct experiments, and sum up experiences so as to further develop and perfect the research-production cooperatives. The experience of the cooperatives tried out by various localities shows that the principle of voluntary participation should be adhered to in setting up such cooperatives. Meanwhile, the administration of the cooperatives must be carried out in coordination with organizational work. The members within a cooperative are linked to economic relations as well as the relations of socialist cooperation. On the basis of mutual benefit, they should cooperate with each other and never practice technological blockades. On the premise of science and technology serving the needs of production and the market, research-production cooperatives should emphasize scientific research, produce research findings, develop new products, and create better economic results.

CSO: 4008/2032

NATIONAL DEVELOPMENTS

RESEARCH CENTER PROMOTES CIVILIAN APPLICATIONS OF S&T ACHIEVEMENTS

Beijing GUANGMING RIBAO in Chinese 9 Jul 85 p 3

[Article by staff reporter Xu Zhimin [6079 1807 2404]: "Space Medicine Engineering Institute Transfers Research Achievements to Civilian Use"]

[Text] Over the last few years, the Space Medicine Engineering Institute emphasized applied development work and promoted transferring research results to civilian use, thereby rendering positive service to the construction of the national economy and building a golden bridge leading from defense science research to social production.

Since last year, the institute has transferred seven defense science research results, such as "antimicrobial No 1," ear muffs to facilitate telecommunications, etc., to local enterprises for production, and responded to 19 requests for technical service by local enterprises. The institute itself trial-manufactured plugs to prevent damage to ears from noise, microwave protective clothing and other similar items that were in short supply in the domestic market. Last year, the institute's output value was over 1.7 million yuan, with a profit of more than 400,000 yuan.

The institute effectively applied the oxygen supply technology used in space travel to develop a portable oxygen supply kit for medical purposes, which is convenient, light and safe to use. They also used the technique applied in the physical evaluation of astronauts to develop a mini-pressure sensor of a pressure-block type for medical diagnoses, which are currently in use at colleges, universities and hospitals in Beijing, Shanghai, Tianjin and Shenyang. They also developed the new medicine "antimicrobial No 1" for operators of radar and microwave communications equipment, a medicine that is high appreciated by the users.

Since 1982, a "developmental research group" has been formed at the institute for the investigation and study of needs in industrial and agricultural production and for market information. Whenever a research result is to be publicized, they will examine its developmental character in four respects: whether it has distinct use value in civilian applications; how the problem of transition from prototype to manufacture of the actual industrial product is to be solved; its production costs and social economic results; and whether the research achievement will be a product complete in all its parts, suitable

for use by the intended users.

This institute is also releasing some of its technical personnel and is making instruments and equipment available to render local services. On different occasions, the institute helped the Qingdao Harbor Bureau and other such entities to complete 19 projects of technological tests and technological reforms. It developed a "blood pressure and pulse measuring device" for the Handan Factory of Electronic Medical Instruments and engaged in a wide range of technical advisory and service activities.

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CSO: 4008/2025

NATIONAL DEVELOPMENTS

JILIN OPENS SCIENTIFIC-TECHNOLOGICAL WORK MEETING

SK050459 Changchun Jilin Provincial Service in Mandarin 2200 GMT 4 Sep 85

[Excerpts] The provincial scientific and technological work conference sponsored by the provincial CPC Committee and the provincial People's Government opened at the provincial guest house on 4 September.

Attending the conference were leading comrades in charge of scientific and technological work from various cities, prefectures, autonomous prefecture, and counties; responsible persons from the scientific and technological commissions, the planning commissions, the economic commissions, the financial departments, and the personnel affairs bureaus in charge of training scientific and technological cadres under various cities, prefectures, autonomous prefectures, and counties; responsible comrades from the provincial level departments, commissions, and bureaus concerned; responsible persons from the state and provincial natural science institutes; and responsible personnel from the relevant higher educational institutions and a number of key enterprises--more than 290 persons in all.

The conference is chiefly aimed at earnestly studying the decision made by the CPC Central Committee with regard to conducting reforms in scientific and technological systems in order to further enhance the understanding on the importance of science and technology and on the emergency of conducting reforms in scientific and technological systems, at discussing the concrete measures for implementing the central decision, and at working out tasks for conducting reforms in scientific and technological systems throughout the province.

Gao Dezhan, governor of the province, presided over the conference (Song Li), chairman of the provincial Scientific and Technological Commission, delivered a speech on relaying the spirit of the national scientific and technological work conference and the speeches given by the central leading comrades.

At the conference, Liu Shulin, vice governor of the province, delivered a report on the province's science and technology work entitled "A Good Job Should Be Done in Conducting Reforms in Scientific and Technological Systems To Promote Economic and Social Development."

In his report, Comrade Liu Shulin stated: Under the leadership of the provincial CPC Committee and the provincial People's Government over the past years, the provincial scientific and technological front has actively conducted some reforms, initially dealt with the problems in the systems concerning leadership on the integration between the economy as well as science and technology, and has conducted reforms in the systems of mapping out plans. The front has also improved the personnel affairs of scientific and technological workers, opened technical markets, accelerated the pace of turning scientific and technological results into productive forces, and has made marked progress in scientific and technological development. Our province has initially built a contingent of more than 360,000 scientific and technological personnel and has set up scientific and technological networks at all levels and in various localities.

In referring to the province's tasks of conducting reforms in scientific and technological systems, Liu Shulin pointed out: At present, we should implement in an all-round way the decision made by the CPC Central Committee with regard to conducting reforms in scientific and technological systems.

In his report, Comrade Liu Shulin urged the leading cadres at all levels throughout the province to regard the work of conducting reforms in scientific and technological systems as a big event as they did in the economic field in order to ensure the smooth progress in scientific and technological reforms, to put the work on their important schedule, to conduct careful guidance, to vigorously carry out the work, and to push forward in a timely and down-to-earth manner the province's program of conducting reforms in scientific and technological systems.

CSO: 4008/2032

REPORT REVIEWS BEIJING'S RESEARCH-PRODUCTION ASSOCIATIONS

HK231421 Beijing GUANGMING RIBAO in Chinese 9 Aug 85 p 1

[Report by Zheng Haining [6774 3189 1337]: "More Than 100 Scientific Research-Production Associations Have Been Set Up in Beijing"]

[Text] According to an investigation conducted by the Beijing Science and Technology Committee, more than 100 research-production cooperatives have been set up in Beijing. These are joint ventures between scientific research, education, and design institutes on the one hand, and enterprises on the other hand. Of the 80 scientific research institutes in the municipality, 25 have established research-production cooperatives or technological joint ventures with enterprises. Both sides have signed 32 contracts on research-production cooperatives and 39 contracts on technological cooperation. So far, 36 scientific research-production cooperatives have been set up under the Beijing science and technology coordination center, while 19 districts and counties have established more than 90 research-production cooperatives. In addition, some cooperatives have also been established between units under the central and municipal authorities.

There are now various forms of research-production cooperatives in Beijing, mainly as indicated below:

Large Municipal-Level Cooperatives: There is a Beijing Science and Technology Exploitation and Exchange Center under the Beijing Science and Technology Committee and its affiliated organizations, and a Beijing Science and Technology Coordination Center under the Beijing Science and Technology Association and its affiliated organizations. The Beijing Science and Technology Coordination Center has contacts with 56 scientific research units, 12 institutions of higher learning, 11 design units, and enterprises of 20 industrial bureaus. They sign hundreds of contracts on cooperation each year.

Research-Production Cooperatives Transcending Provinces and Cities: The Beijing Science and Technology Committee and Qinhuangdao have jointly set up the "Beijing-Qinhuangdao Science and Technology Exploitation Company," which deals with the transfer and exchange of research findings and which is a joint operation. The company is directed by a council consisting of representatives from both sides.

Intentional Cooperation: An example of this is the forest and fruit research unit of the Beijing agricultural and forestry institute, which signed a contract with Hhangxinzhuang Brigade, Tongxian County on jointly developing 1,000 mu of standard orchards. The Beijing Labor Insurance Company and Sijiqing Township, Haiding District, jointly established a labor and technology exploitation company. The research units provide technology and research findings, while the rural collective units provide land, labor, and workshops. Both sides jointly carry out production and share the profits.

Multi-Party Cooperation: A scientific research unit selects some enterprises for joint operation and both sides form a council to carry out joint management. The joint venture practices independent accounting, assumes sole responsibility for its profits and losses, and shares the profits. The research units provide the technology and scientific research findings as their investment, while the enterprises provide labor, equipment, workshops, and most of the capital.

Cooperation Between Economic Bodies: Scientific research units or institutions of higher learning set up new joint ventures with enterprises. For example, Qinghua University and the Tongxian mini-motor plant jointly set up the Jinghua Electric Equipment Company. The Beijing Farm Machine Company and Qiliqu Township, Changping County jointly established the Yunfeng Electric Equipment Plant.

Cooperation in Contracting Certain Technological Projects: Some research institutes contract certain technological projects for enterprises, which then cover the expenses of the research. The research institutes provide design, data, equipment, and technology, while the benefitted enterprises pay annual technology service fees.

Cooperation Between Counterpart Organizations: An example of this is: Three research units under the Beijing mechanical engineering research institute offered services to three respective counterpart factories. The research institutes undertook the responsibility for developing new products and upgrading old ones, while the benefitted factories paid research fees.

The activities of the cooperatives have raised the application rate of Beijing's scientific and technological achievements. There are 23 research institutes in the municipality that have tried the system of signing contracts with user organizations that pay remuneration. The application rate of their scientific and technological achievements is over 50 percent. The 80 research institutes in Beijing contracted 1,274 technological items for enterprises in 1984, an increase of 61 percent over 1983. In addition, they transferred 396 research achievements to enterprises, an increase of 162 percent.

CSO: 4008/2032

NATIONAL DEVELOPMENTS

ADVANCED TECHNOLOGY FLOWS FROM SHANGHAI TO INTERIOR REGIONS

Beijing RENMIN RIBAO [OVERSEAS EDITION] in Chinese 10 Jul 85 p 3

[Article by Shen Shiwei [3088 0013 4885] and He Zijia [0149 1311 5521]: "Shanghai Successfully Transmits Advanced Technology to the Interior; Over 500 Cooperative Projects With Several Remote Border Regions During the Last 2 Years"]

[Text] Shanghai has energetically disseminated information and actually transfered advanced technologies and managerial experiences to the interior, acting as a kind of radiator directed toward the interior. The intensity of this radiation is growing increasingly stronger, evoking an excellent "radiation effect."

Shanghai's active engagement in economic and technological cooperation with fraternal regions and in the establishment of joint economic entities of various forms amounted to more than 1,000 cases last year, over double the cases in the preceding year. In the last 2 years, Shanghai concluded more than 500 projects of technological cooperation with such minority nationality regions as Yunnan, Ningxia, Xinjiang and Tibet.

Shanghai's radiating force shows itself in a "move toward the interior" of intelligence and technology, a transplantation that has already taken root in the various regions and has produced a rich harvest:

A series of famous-brand products have found their home in the fraternal regions. For all such famous-brand products as the "Honeybee" sewing machines, "Phoenix" and "Yongjiu" bicycles, "Space" shuttlecocks and the "Golden Star" and "Kaige" TV sets, their Shanghai manufacturers have organized joint production arrangements with counterpart-enterprises in the fraternal regions. Three objectives have thereby been accomplished with one stroke: Shanghai expanded production of famous-brand products, Shanghai released some of its own capacities for the development of new products, and the outlying regions could upgrade and update their own products. After three bicycle factories in Suzhou, Shaoxing and Nantong and two factories in Shanghai have combined, capacity can this year be expanded by a production of 1.2 million famous-brand bicycles, which is about one-fifth of all the bicycles manufactured in Shanghai.

Lending wings for a "soaring ascent" of fraternal factories. Although well equipped with excellent machinery, the Yentai Broadloom Textile Mill incurred a loss of 620,000 yuan in the 5 1/2 years since its inception due to insoluble difficulties in weaving and dyeing techniques and a lack of managerial experiences. In 1983, the said textile mill started to link up with Shanghai's No 36 Weaving Mill, Pacific Ocean Weaving Mill and No 2 Printing and Dyeing Mill. Shanghai dispatched "crack troops and able generals" to help solve all difficulties from techniques to management, and the mill was indeed able that year to transform deficit into profit, with another steep increase last year, when the profits of the preceding year were doubled.

In the outlying district, it was possible to transform quickly a number of scientific research achievements into productive forces. The Fudan University transferred its "glutamic acid one-step glucose breakdown fermentation technique" to the Jiangsu Haimen Monosodium Glutamate Factory. On applying this technique, the yield ratio of the factory rose above 90 percent, and the ratio of acid production came close to advanced international levels. Shanghai's institutions of higher learning and scientific research institutes have established more than 100 joint research and production entities with the fraternal regions. Advisory organizations in Shanghai, numbering almost 500, have handled more than 10,000 enquiries from the fraternal regions concerning such matters as production technologies, engineering projects, business administration, news and information, finance and trade.

Presently, this kind of radiating strength of Shanghai is being further developed in depth on three levels: the first level is following the principle of cooperation between various specializations for a further intensification of economic union within the Shanghai economic region; the second level is the development of an economic union based on the Chang Jiang and extending over the entire Chang Jiang drainage area; the third level is economic cooperation with all regions of the whole country, particularly with the remote border regions. People are gratified to note that as the reform of the economic system is progressing in greater depth, Shanghai's role as a radiating power of a key city is further widening, and that its "radiation effect" on the entire country is sure to increase.

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CSO: 4008/5025

NATIONAL DEVELOPMENTS

IMPLEMENTATION OF PATENT LAW, TECHNICAL MARKETS DEVELOPMENT

Beijing ZHONGGUO ZHUANLI [PATENT REVIEW OF CHINA] in Chinese No 1, 1985
pp10-12

[Address by Lin Zong tang [2651 1350 2768] vice minister of the State
Economic Commission, to the First National Patent Conference]

[Text] Here, I would like to explain our stand and make a few comments on
the implementation of the Patent Law and the development of technical
market.

I. Implant into Our Souls the Strategic Thinking That Economic Growth Can
Only Be Attained Through Scientific Technologies

Since the 3d Plenary Session of the 11th Party Central Committee, our
economy has been thriving. Total industrial and agricultural output value
has been growing at an average of 8.2 percent a year over the past 5 years,
surpassing the planned yearly growth of 7.2 percent which is demanded by
the national goal of quadrupling output by the end of this century. The
total output value of industries and enterprises, from January to October
of this year, had gone up by 10.9 percent, profit tax receipts showed a
real increase of 11.8 percent and total revenues were 11 percent more than
they were in the same period of last year; this progress indicates that the
goal of the "three synchronizations" in total production value, real profit
taxes and total revenues has been achieved. The rural economy, as a whole,
is also doing well this year. The output of grains is expected to reach
800 million jin and cotton output comes to 1.1 million dan. Commodity
circulation is also booming and shows good prospects. However, support for
the continued expansion of our economy still must be derived from the
advances made in technological development. In today's international
trade, competition for markets is fierce, and by its very nature, trade
competition is a technological contest. For developed countries, a
relatively large proportion of economic growth is directly related to
technology development: the figures have risen from around 5 percent at the
beginning of the 20th century to no less than 60-80 percent today in some
industrialized countries; on the other hand, the share in our industrial
growth contributed by developments in science and technology is only 26
percent.

At present, the quality of our industries and enterprises is fairly low, and a major cause of this problem is the low level of our technology as well as its slow development. Indeed, we can find many faults responsible for our failure in this field, and one of our more serious mistakes in the past, among others, is the neglect of scientific technology and the mistreatment of intellectuals. The root of our backwardness in technology lies in the fact that we did not care much whether our enterprises were developing properly or not; workers were paid the same wages and shared comparable rewards regardless of whether they had been pushing for progress or not. As a result, the attitude of eating out of the same pot and receiving equal benefits practically eliminated all the incentives that people had to pursue for development in technology. This fallacious policy should be corrected immediately. Today, we are facing two major tasks: improvement in management and control and the development of new manufactured goods. We understand there are many problems associated with these two tasks. Comrade Deng Xiaoping said that among the resolutions passed by the 3d Plenary Session of the 12th Party Central Committee, the most important one is Resolution 9 which calls for people to revere knowledge and respect intellectuals. It is imperative for us to follow Comrade Deng Xiaoping's request to "revere knowledge and esteem specialists" and to pursue advances in science and technology in order to modernize our nation, reform the economy and achieve the goal of quadrupling output. We should also realize that a key link in our technology development program is how we can best transfer the results in the fields of science and technology into direct producing power.

Therefore, our science and technology research program should be tailored to meet the needs of our national economic development and targeted to make China prosperous and powerful in the shortest time possible. It is true that progress made in scientific and technological research may lead to industrial growth, yet, at the same time, the usefulness and prolific effects of new theoretical discoveries in science and technology can only be exploited to the full after the industry has advanced into a highly developed stage. Clearly, the mutual understandings and the unified state within the system of "science-technology-production" must therefore be effectively regulated. The advance in basic scientific research is the driving force for technological development, and technology is the application of scientific principles in the real world, whereas manufactured goods are the materializations of science and technology. Technological innovations can only be attained through the concerted effort of a unified "science-technology-production" system; the three should work closely together, complement each other and function as a well-coordinated unit. Thus, we can expect the implementation of the patent Law and the opening of the technology market to create favorable conditions for inventions and innovations, accelerate the transformation and application of new technologies and encourage a close coordination between basic research in science and technology and production development as well as promote the conversion of intellectual resources in science and technology into the material wealth that can be shared by the society.

The enactment of the Patent Law will also facilitate the importation of advanced technologies. One of our established long-term strategic policies for economic development dictates the active use of foreign capital and the introduction of foreign technology. An important lesson we have learned from our endeavors to industrialize China in the past several decades is that while carrying out the self-reliance policy, we failed to strengthen further our self-supporting ability and accelerate our economic growth by making the best use of favorable international conditions to import outside technology and investments. Advanced technologies are creative products by the collective efforts of people all over the world: we should bring in foreign high technology by all possible means for our own use, as if we were marching forward on a giant's shoulders, that is, start out on a high groundwork which not only affords an extensive view but also makes the ascent less strenuous. This is what I would call real self-reliance. Although our open door policy has enabled us to bring in thousands of advanced technologies, the importation of advanced, high grade and state-of-the-art technologies remains very difficult; the major obstacle is the foreign businessmen's concern about lack of legal protection in China for their rights in transferred technologies. The implementation of the Patent Law will offer protection for legal patent rights and should alleviate their concerns, at the same time furnishing a mandatory provision for introducing high technologies into China. This is an important step in promoting foreign enterprises and individuals to come to our country to apply for patent rights, market their products and conduct technology exchanges and consequently it enables us to import the most advanced technologies in the world on easier and better terms, allows the technical trade between China and other nations to take on a larger dimension than before and helps our economic development to press forward.

II. Double Our Efforts To Develop the Socialist Technology Market

To pursue technological advances, we must arouse the full enthusiasm of the mass of scientific and technocratic professionals and motivate them to devote themselves to this great undertaking. In addition, we should make the very important ideological stand clear to each and everyone: in conformity with socialist commodity exchange conditions, the result of scientific and technological research is also considered a form of commodity and can be circulated and traded.

Leading comrades from the State Council recently issued a number of important directives on technological commodities and the technology market; we should take these instructions as our basic ideological guidelines for developing the technology market. In the past, for a fairly long period, we were not able to deal properly with the bottleneck of the dependence of our economic development on science and technology and the dedication of our scientific and technological research program to economic development. On the one hand, industry did not pay enough attention to promote progress in the fields of science and technology, and the basic research side was ignorant of the scientific and technological problems involved in production; quite simply, because we failed to realize that scientific and technological inventions and innovations are commodity equivalents, the

production people did not bother to evaluate new products and other technological inventions and innovations or examine and calculate the costs of their application in manufacturing and marketing while the research and development people did not wish to share their research results. The indifferent attitude of industry toward technological development and of the scientific and technocratic field toward research achievements practically rid the mass production workers as well as the scientists and technocrats of their incentive for invention and innovation. The opening of the technological market will make it possible to adjust the income of those engaged in production together with those in research and development to a scale directly proportional to their contributions to economic growth, and it will fundamentally correct the unsatisfactory state of affairs of the incoherence between science and technology on the one hand and enterprises on the other and the prevalent negligent attitude of scientists and technocrats. To effect a thorough reform in this aspect is of the utmost important and urgency.

As for the technology transfer fee, the price of a technological commodity can be left to market regulation. In the beginning, we may try a more liberal pricing system, allowing flexibility and developing an active market; subsequent minor problems, if any, can be dealt with later. Technological commodities deserve higher prices. When people start to appreciate the value of new technologies, the greater the market demands, the more the technologies merit and, consequently, the more valuable inventions and innovations become. There will be more revenues for the nation and better rewards in it, and for scientists and engineers as well. Therefore, scientists and technocrats will have the incentive to be more concerned in promoting the industrial applications of their research achievements. There is nothing wrong in establishing technology transfer fees. It should be obvious that the more the country and the enterprises spend in giving reward money, the better our chances in successfully modernizing our nation. The scientists and technocrats who have made indispensable contributions in technology development should be awarded with a certain portion of the transfer fees. The principle of equal distribution is no longer applicable here; the reward money is meant to recompense individuals whose efforts have made the technological advance possible. The idea is to renumerate those directly involved in invention and innovation with rewards and recognition.

Generally, there are three approaches to incite the scientists' and technocrats' greater work efforts: first, the rights of the work accomplished according to the research institute's proposal belong to the institute, and those who have taken part in the project and made important contributions should be handsomely rewarded. This is the most important of the three. Second, research projects initiated by staff members who wish to contribute more ought to be funded by the institute. Researchers whose efforts have brought about achievements can expect exceptional rewards from the resulting returns. Third, individuals retain the rights to their own projects completed in their spare time but must compensate for the institute's instruments and materials used in private projects. There should be a users' fee.

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We can foresee many other benefits that the establishment of the technology market can bring: it can inspire our dedicated mass of scientists and technocrats to redouble their efforts for the cause of national growth goals and devote themselves to pursue solutions to technological problems in various areas associated with economic development; the flood of technological inventions and innovations can break through regional, departmental and organizational obstacles and find their way to industrial applications at an accelerated pace; scientists and technocrats, regardless of their affiliations, will have much closer ties to the society and market and thus be in a position to initiate technology transfers for their research results or innovations, which would not have been possible previously for researchers without first securing transfers to the outfits of their interests; it can institute the reward-based-on-merit policy, providing more profit-sharing opportunities for talented professionals who are willing to put in greater efforts; and industries will be able to obtain the technologies they need from the technology market and not necessarily rely entirely on their own research and development capabilities for technological advances. Therefore, it appears that the best way to develop science and technology and reform economics is via the establishment of the socialist technology market and a pricing system for technological innovations based on market demand, which may some day provide the starting point from which the reform program for our national scientific research system is launched. In recent years, notably after the 3d Plenary Session of the 11th party Central Committee, there have gradually appeared technology transfers with financial compensation and invention trade fairs; these exchanges have been well received by the public and have brought about accelerated economic growth as well. To keep this positive trend going, we must establish and develop a prosperous technology market, lay a solid foundation for good practices and exercise proper controls.

III. The Great Task of Implementation of the Patent Law and Development of the Technology Market Awaits Us

Since technology is a product of intellectual or mental labor, an abstract commodity, its proper price, because of the many factors involved, is difficult to determine and may not always reflect its real value. Consequently, the regulation of circulation and the exchange of technological information in the market cannot be dealt with merely by inflexible administration controls; it must be covered by specific legislation and a complete set of regulations so that the technological information can be circulated normally at a price level conforming to its real worth and so that its application in enterprises in a healthy, proliferating manner can thus be ensured.

The Patent Law of China embodies the characteristics of Chinese socialism and has been well received both at home and abroad. It will take effect on 1 April 1986. This is an important step with far-reaching effects. The implementation of the Patent Law and the establishment of a technology market present a great opportunity as well as a challenge for our mammoth force of scientists and technocrats and enterprises. In the 35 years, since

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the founding of the People's Republic, we have developed a relatively complete basic industrial capacity. It is time for us to cultivate a strong force of research workers, and we trust that our scientists and technocrats are devoted to our country and have a strong desire to do whatever China asks them to do. I might add that the Chinese people has been known for their diligence, bravery and creativity for centuries. Today, the pending enactment of the Patent Law and the establishment of the technology market in China are just like what Comrade Hu Yaobang once said: they "comply with the mandate of the people and follow the water current." We should resolve to "make rapid advances in the fields of science and technology so that we will not feel shame before the achievements of our ancestors" and face this great challenge with dauntless determination and capitalize on this opportunity to realize our national technological and economic development goals.

In the past, the thinking of a natural economy exerted a considerable number of ill effects on the development of science and technology and on the economy of China. Enterprises, factories and mining companies, whether large or small, had long been accustomed to the practice of self-complementing, shutting themselves from the outside world. As a result, research projects largely consisted of low-level studies, many of them duplicated. Technological achievements were not considered as commodities and people were mentally disposed to the "left," adopting an attitude of "equalitarianism and indiscriminate transfer of manpower, land, drought animals, farm tools, funds, etc.," "eating out of the same big pot" toward pursuing research results. We must rid ourselves of this kind of faulty thinking, lest the implementation of the Patent Law and the establishment of a technology market be blocked by obstacles and the growth of technology impeded. Hence, we must speed up our learning, especially by those comrades who are in leadership positions, and should earnestly study economic laws and related regulations such as the Patent Law, the Provisional Regulations on Technology Transfers and others under the guidance of the resolutions of the 3d Plenary Session of the 12th party Central Committee in order to acquire the new skills for managing economic affairs of a technological nature. This is a very serious task awaiting us. Those of us who wear the hats of plant manager, manager and research institute director should become experts in patent administration and technological trade, grasp know-how and develop the necessary expertise in these fields.

An important mission is facing us. The administration of patent rights is a job that requires great intelligence and thus presents us with the challenging problem of training a competent team to perform this function. To get a large administrative staff as well as a large number of scientists and technocrats to understand the Patent Law and to instill in them the legal concept of the inviolability of industrial patent rights creates a second task, that is of introducing and publicizing the Patent Law and mobilizing people to study the provisions of this law. In addition, in order to ensure that the administration of patent rights develops smoothly and the technology market flourishes, we should set up a managing system which runs in good order at all levels and prepare ourselves well for the

impending mission. The Patent Bureau and concerned authorities in the local and central governments have been working very hard and have made much progress in recent years. We should look for continuous progress, keep on improving as the actual situation dictates and move forward with ingenuity and creativity. District and regional authorities, concerned departments and party committees ought to join in, pay more attention and attach much importance to the implementation of the Patent Law and the establishment of the technology market. Regional agencies for patent rights and technological market administration should be set up by local authorities in accordance with their particular needs.

It is imperative for us to put a patent rights and technology market administrative system in good order as soon as possible in order to be prepared for the implementation of the Patent Law and the establishment of a socialist technology market. We hope we can all work together, double our efforts to enact the Patent Law and develop the technology market and devote ourselves to achieving the national development goal of quadrupling output by the year 2000, reconstructing China and fulfilling our assigned mission to contribute to the great leap forward of the Chinese people.

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CSO: 4008/339

NATIONAL DEVELOPMENTS

PRC SETS UP NATIONAL MARKET DEVELOPMENT CENTER

OW101402 Beijing XINHUA in English 1153 GMT 10 Sep 85

[Text] Beijing, Sep 10 (XINHUA)--The State Science and Technology Commission has set up a National Market Development Center to promote the circulation of scientific research findings and technology.

The trade in technology and the opening up of the technology market are regarded as major initial steps in the country's current reform of the science and technology management system.

There are now more than 2,000 technical exchange centers and technology development companies across China, working to integrate science with economic construction.

The newly-established center will organize technical trade fairs and exchange scientific information between various organizations and departments, and provide consulting services relating to credits, patent and law.

At the same time, the center will make efforts to channel China's scientific research findings and industrial technology into the international technology market.

China has also established a national coordinating group to take charge of planning legislation for the technology market.

At present, the group is drafting the "Provisional Regulations Concerning Management of the Technology Market", "Several Economic Measures to Support the Technology Market", "Law on Technical Contracts" and "Regulations Concerning Statistical Work in the Technology Market."

In the first half of this year, 18 major technical trade fairs were held in China with a total turnover of 9.6 billion yuan.

CSO: 4010/2015

NATIONAL DEVELOPMENTS

PRC TO ANNOUNCE PATENT APPLICATIONS IN GAZETTES

OW101122 Beijing XINHUA in English 1041 GMT 10 Sep 85

[Text] Beijing, Sep 10 (XINHUA)--The China Patent Office announced its first patent applications here this morning.

The first 150 applications include 46 for patents for inventions, 65 for patents for utility models and 39 for patents on designs which have gone through preliminary examinations.

While most of the applications came from Chinese inventors, some were from foreign countries. These include two for inventions, three for utility model patents and 21 for patents on designs.

Since the patent law of the People's Republic of China went into effect on April 1 this year, the China Patent Office had received 9,867 applications through September 9. Of these, 3,235 applications were filed by foreign applicants, he said.

The patent office also published the applications for invention patents already examined, applications for invention patents and applications for patents for utility models.

Huang Kunyi, director general of the China Patent Office, said, "From today on, China begins to have its own patent documentation. This will form a complete set of publicly circulated technical files which will play an important role in spreading information on inventions-creations and in popularizing and applying new technologies."

"It is of historic importance for Chinese documents to be added to the world treasure house of more than 30 million patent documents," the director general said.

Huang said the office plans to publish gazettes monthly in order to announce patent applications batch by batch. Starting from next year, it will publish gazettes weekly if circumstances require it, he said.

Huang said it is important for the patent office to publish the applications before they are granted and to allow others to have a chance to file opposition to them, in order that the quality of patents is ensured. The time limit for raising questions is three months from the date of announcement. By the end of the year, Huang said, the patent office expects to grant the first patents.

There are 1,368 regular subscribers to gazettes of patents and applications nation-wide. A network of 64 patent documentation service centers also has been set up in the various provinces, autonomous regions and municipalities for non-subscribers, Huang said.

The China Patent Office has established relations of exchanging patent documents with 14 countries and two international patent organizations. It will also publish an English edition of the abstracts of Chinese patent applications, the director general said.

CSO: 4010/2015

NATIONAL DEVELOPMENTS

ZHEJIANG SCIENCE, TECHNOLOGY CONFERENCE OPENS

OW251303 Hangzhou Zhejiang Provincial Service in Mandarin 1000 GMT
23 Aug 85

[Text] The provincial science and technology conference opened at Moganshan
on 23 August. More than 500 people, including responsible comrades of
city, prefectural, and county governments, and other departments concerned,
as well as scholars and experts of scientific and technological units,
colleges, and universities, will exchange experiences in the reform of
the science and technology management system in the past year, study the
strategy for the development of science and technology in the province,
and formulate measures for further implementing the CPC Central Committee's
Decision on the Reform of the Science and Technology Management System.

Leading comrades of the provincial CPC Committee, the provincial People's
Congress Standing Committee, the provincial people's government, and the
provincial CPPCC Committee, Xue Ju, Wu Minda, Wang Qidong, Li Debao,
and Wang Jiayang attended today's meeting. (Wu Rugong), representative
of the State Science and Technology commission, also attended the meeting.

At the meeting, Vice Governor Li Debao relayed the guidelines of the national
science and technology conference. Chen Chuangun, chairman of the Provincial
Science and Technology Commission, delivered a report on scientific and
technological work in the province.

In the past year, the province has gradually carried out reform in the
science and technology management system. Some 20 percent of research
institutes in the province have carried out structural reform in pilot
units and opened up technical markets. More than 40 science and technology
fairs have been sponsored in the province, cities, prefectures, and counties,
where large numbers of technological achievements were marketed. Many
scientific research institutes, colleges, universities, and enterprises
have established various forms of cooperation and integrated establishment
to enhance the enterprises' capability for technology absorption and
development.

In the meantime, the province has also scored achievements in reforming
the system of popularizing science and technology in rural areas. However,

due to inadequate understanding and structure as well as other factors, many problems still remain with regard to integration between economy and science and technology.

In his opening speech, Comrade Wu Minda stressed that leaders at all levels should attach greater importance to scientific and technological work and the reform of the science and technology management system, and be determined to solve the problem of alienation of the economy from science and technology. Economic departments should pay attention to and support scientific research. They should enhance the role of scientific and technological forces in enterprises under their respective units, as well as in the society at large, including scientific research institutes, colleges, and universities. Economic construction should rely on science and technology. Scientific and technological departments should orient their work toward economy, work for economic development, make concerted efforts to achieve success through exploitation of intellectual advantages, and thoroughly change the present situation in our province where economic development is dependent on traditional skills and crafts, and on management.

Representatives to the meeting began group discussions on the afternoon of 23 August.

CSO: 4008/2032

NATIONAL DEVELOPMENTS

SHANDONG COMMENTARY ON SCIENTIFIC AND TECHNOLOGICAL REFORM

SK260505 Jinan Shandong Provincial Service in Mandarin 2300 GMT 24 Aug 85

[Station Commentary: "Cater to the Needs of Economic Construction and Do a Good Job in Scientific and Technological Reform"]

[Text] The provincial scientific and technological work conference has come to a successful end. This conference indicated a major turn in our province's scientific and technological work and reflected the fact that our province's scientific and technological structural reform has begun to enter a new stage of comprehensive development. This conference will surely exert a major and far-reaching influence on our provincial scientific and technological development and economic construction.

With the deepening of economic structural reform, the defects in the scientific and technological structure have become more and more obvious, such as in operational mechanisms, in organizational structures, and in the personnel affairs system. The core of these problems is that we have failed to fully understand and appraise the value of intellectual work and to acknowledge that scientific research achievements are also commodities and that we have simply used administrative means to manage scientific and technological work. These are not only harmful to the development of scientific and technological undertakings but are also not in conformity with the development of the socialist commodity economy.

To make science and technology cater to the needs of production, we must acknowledge the value created by intellectual work and turn scientific and technological achievements into commodities; integrate scientific and technological creations, innovations, and application with the interests of the scientific research units and scientific and technical workers; and enable the scientific research organs to have capabilities for development, vitality for serving economic construction, and to consciously and vigorously serve the whole society. The key to closely linking science and technology with economic construction and establishing vigorous new scientific and technological structures lies in invigorating the scientific research units.

For a long time we have simply relied on administrative means to lead scientific and technological work. The scientific research units and the

scientific and technical workers have had to eat from the same big pot simultaneously. This is the fundamental reason for separating scientific research from production. To make economic levers and the law of value direct scientific and technological work, we should reform the scientific and technological funding system, open up technological markets, implement the policy of paying for the transfer of scientific and technological achievements, and speed up the application of scientific and technological achievements, and speed up the application of scientific and technological achievements to production.

Meanwhile, we should also readjust the structure of scientific and technological organizations, strengthen lateral ties, strengthen the capabilities of enterprises in absorbing technology and in development, and enable science and technology to turn into productive forces within a short period of time. So long as we conscientiously implement the guidelines of the central decision on reform of the scientific and technological structures and adhere to the principle that we must be steadfast and prudent in fighting the first battle and be sure to win, we will surely guarantee the success of scientific and technological structural reform, and will contribute to making the people and Shandong Province rich and China prosperous.

NATIONAL DEVELOPMENTS

BRIEFS

EUROPEAN TECHNOLOGY EXHIBIT OPENS IN SHENYANG--Shenyang, 9 Sep (XINHUA)--An
exhibition of modern European industrial technology opened today in Shenyang,
capital of Liaoning Province. On display are electric appliances, farm
machinery and metallurgical and light industrial equipment from 37 firms
in the Federal Republic of Germany, the United States, Austria, Finland,
Italy and Norway. The six-day exhibition is sponsored by Nowea A.G. of
Dusseldorf, Federal Germany. Shenyang and Dusseldorf established cooperative
ties last September. [Text] [Beijing XINHUA in English 1251 GMT
9 Sep 85 OW]

CSO: 4010/2015

PHYSICAL SCIENCES

CW-CO$_2$ LASER SENSITIZED CFHCl$_2$ REACTION

[Article by Shi Jiliang [0670 3444 5328], Shen Xueqiang [3088 1331 1730], Song Jianping [1345 1696 1627] and Yao Jiexing [1202 0094 5281], Shanghai Institute of Organic Chemistry, Academia Sinica]

[Text] Abstract: This paper reports the CW-CO$_2$ laser sensitized CFHCl$_2$, CFHCl$_2$+O$_2$ and CFHCl$_2$+Cl$_2$ reactions, the analysis of the products and discusses the mechanisms of these reactions.

It is found that, CFCl carbene can be generated in gas phase by laser sensitized reaction and the yields of CFClO, CF$_2$O, CFCl$_3$ and CF$_2$Cl$_2$ obtained by laser sensitized oxidation and chlorination of CFHCl$_2$ and CF$_2$HCl[1] are nearly quantitative.

Key words: CO$_2$ laser, sensitization, freon, carbene.

Professor Bauer[1] at Cornell University of the United States has carried out extensive studies on laser sensitized homogeneous pyrolysis. He suggests that, at room temperature, there is no "hot wall" effect in the laser sensitized pyrolysis process by laser irradiation. Therefore, the rise times for heating are shorter ($\sim$ms) and the equipment involved is simple. In this article, the production of carbenes and some simple reactions of carbenes are studied by laser sensitization method.

Shi Jiliang and coworkers[2] have studied the possibility of producing CF$_2$ and CCl$_2$ carbenes in gas phase in the laser sensitized reactions of CF$_2$HCl and CHCl$_3$. In this article, using SF$_6$ as sensitizer and under the irradiation of CW-CO$_2$ laser, the production of CFCl carbene from CFHCl$_2$ and the reactions of CFCl carbene with O$_2$ and Cl$_2$ are studied. Under the condition, the production of CFCl carbene from CFHCl$_2$ is a pyrolysis process and is one of the methods to produce CFCl carbene.

Experimental Procedure

The output of CW-CO$_2$ laser is about 10 W. The irradiation vessel and sample preparations were described before.[1]

Chemicals: The purity of SF$_6$ and O$_2$ are both 99.9 percent. CFHCl$_2$ was purchased from Shanghai Electrochemical Plant and was purified by preparative gas chromatography to remove the impurity CF$_2$HCl.

Instruments: The Zeiss specord 75 IR spectrophotometer and Model 100 gas chromatograph were used.

1. Laser Irradiation of CFHCl$_2$

Under the pressure of 7 torr, the sample was irradiated for 3 minutes with 20 W nontunable CW-CO$_2$ laser and was then analyzed with IR spectrophotometer. The results showed no change in IR spectra before and after irradiation.

2. Laser Irradiation of SF$_6$+CFHCl$_2$

The composition of gaseous sample irradiated is SF$_6$:CFHCl$_2$=6:57 and total pressure is 63 torr. After irradiation for 5 minutes, it was analyzed by gas chromatography. The second chromatographic peak of product has the same retention time as that of the reference CFCl=CFCl, thus confirms CFCl= CFCl as major product (see Figure 1). When the sample load was increased, the trailing peaks with a retention time of 33 and 73 minutes, respectively, were detected. They are probably the product peaks of C$_3$ or larger species.
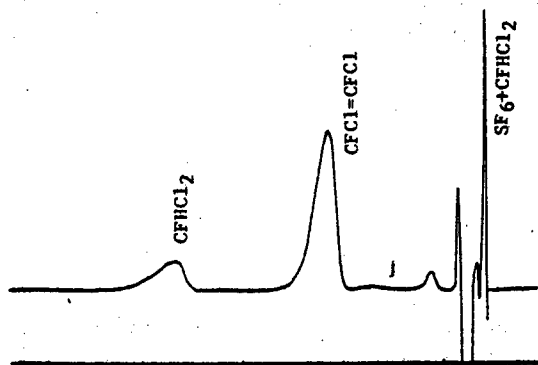

Figure 1. Gas Chromatogram of SF$_6$+CFHCl$_2$ Irradiated by CW-CO$_2$ Laser

Condition: Column: 6402 silica gel + 5 percent apiezon;
Column length: 2m; Detector: thermal conductivity cell;
Column temperature: 30°C; Carrier gas: N$_2$; Chart speed:
1 cm/minute.

3. Laser Irradiation of $SF_6+CFHCl_2+O_2$

The composition of irradiated gas: $SF_6:CFHCl_2:O_2=7:7:71$. Total pressure: 85 torr.

The sample was irradiated for 5 minutes. Its IR spectra showed new absorption peaks, the major one being CFClO ($1850\sim1880$ cm^{-1} and 1095 cm^{-1}.) There were also the CF_2O absorption peak ($1920\sim1950$ cm^{-1} and $1230\sim1260$ cm^{-1}) and CCl_2O absorption peak (850 cm^{-1}, it should also absorb at 1827 cm^{-1} but probably was masked by CFClO peaks) Based on the intensity of these peaks, the major reaction product is CFClO with traces of CF_2O and CCl_2O (see Figure 2).
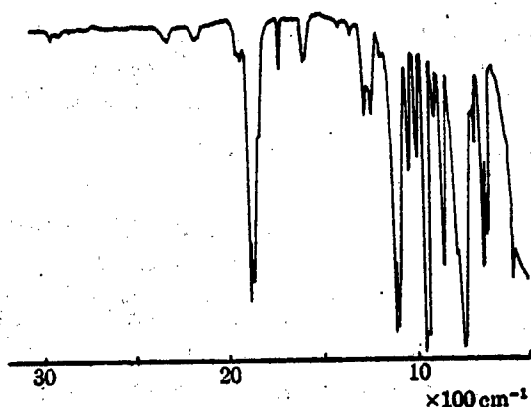

Figure 2. IR Spectrum of $SF_6+CFHCl_2+O_2$ Irradiated by CW–CO_2 Laser

(Note: The peak at ~730 cm^{-1} is due to the absorption of KF present in the KCl window of the reaction vessel.)

4. Laser Irradiation of $SF_6+CFHCl_2+Cl_2$

The composition of irradiated gas: $SF_6:CFHCl_2:Cl_2=5:20:61$. Total pressure: 86 torr.

After laser irradiation for 10 minutes, the sample was analyzed by gas chromatography and IR spectroscopy. The IR spectrum showed that the major characteristic absorption peak of $CFHCl_2$ diminished noticeably after the irradiation and the strong absorption peak of $CFCl_3$ (~1080 cm^{-1} and ~830 cm^{-1}) appeared. There were also the strong vibrational-rotational absorption peak of HCl (see Figure 3).

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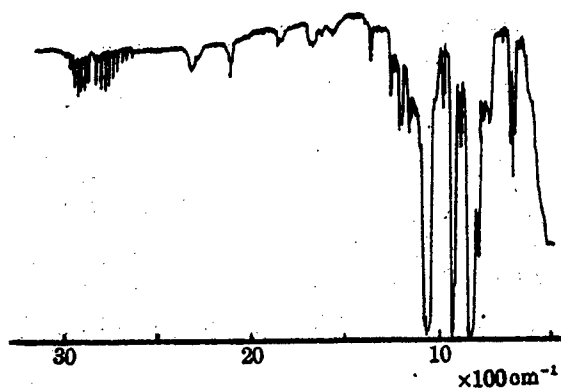
Figure 3. IR Spectrum of $SF_6 + CFHCl_2 + Cl_2$ Irradiated by CW-CO_2 Laser

The gas chromatographic analysis also showed the major reaction product as $CFCl_3$ (see Figure 4A).
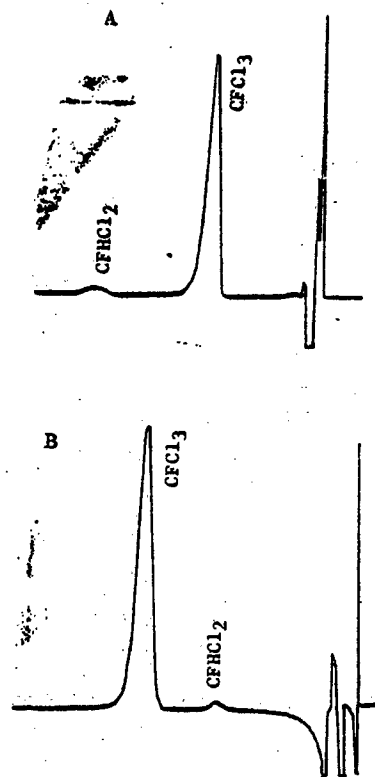
Figure 4. Gas Chromatogram of $SF_6 + CFHCl_2 + Cl_2$ Irradiated by CW-CO_2 Laser

The condition of A is the same as in Figure 1.
The condition of B:
    Column: Porapak Q; Column length: 2 m; Detector: thermal
    conductivity cell; Column temperature: 140°C;
    Carrier gas: N_2; Chart speed: 1 cm/minute.

However, under the condition of Figure 4A, the peak of reference standard $CFCl_3$ overlaps with that of $CFCl=CFCl$, which interferes with the confirmation of the major product $CFCl_3$ from laser sensitized chlorination of Freon 21 because the possibility of producing $CFCl=CFCl$ by the process $2\ CFCl \longrightarrow CFCl=CFCl$ cannot be excluded.

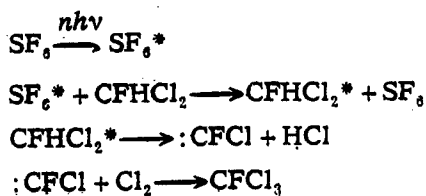For this reason, a chromatographic condition in which the peaks of $CFCl_3$ and $CFCl=CFCl$ are resolved has been developed. The results showed that, other than SF_6 and unreacted $CFHCl_2$, the major product was $CFCl_3$ and no other products were detected (see Figure 4B).
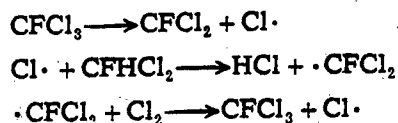
Discussion

When irradiated by nontunable CW-CO_2 laser, $CFHCl_2$ does not absorb the CO_2 laser light. Only in the presence of sensitizer SF_6 does reaction with $CFHCl_2$ occur. Based on the principle of minimum energy route, the primary process of the reaction should be $CFHCl_2^* \longrightarrow CFCl+HCl$. This reaction has been reported by Lee, et al.,[3] in their study of the primary process of multiphoton dissociation of $CFHCl_2$ by tunable carbon dioxide laser and molecular beam methods. The reaction product $CFCl=CFCl$ should come from the recombination of 2 CFCl carbenes. In the laser sensitized oxidation reaction of $CFHCl_2$, the major product obtained in the experiment is $CFClO$, arising from the reaction of CFCl and O_2. In this oxidation reaction, traces of CF_2O and CCl_2O were also present. The formation of CCl_2O is probably due to the reaction $CFHCl_2^* \longrightarrow CCl_2+HF$ with subsequent reaction of CCl_2 with O_2. Furthermore, according to the literature,[1] in the process of CF_2HCl oxidation, CF_2O and $CF_2=CF_2$ were detected initially but $CF_2=CF_2$ diminished with increasing laser irradiation time and only CF_2O remained. By analogy, in the laser sensitized oxidation of Freon 21, $CFClO$ and $CFCl=CFCl$ should be similarly formed and the latter can be rearranged to form $CF_2=CCl_2$ under laser sensitization with further degradation to form CF_2 and CCl_2, which then react with O_2 to form CF_2O and CCl_2O, respectively.

Based on the discussion of Popok, et al.,[4] on the mechanism of TEA-CO_2 laser induced reaction of CF_2HCl and Cl_2, the possible mechanism of laser sensitized chlorination of CF_2HCl are presented as follows:

$$SF_6 \overset{nh\nu}{\longrightarrow} SF_6^*$$

$$SF_6^* + CFHCl_2 \longrightarrow CFHCl_2^* + SF_6$$

$$CFHCl_2^* \longrightarrow :CFCl + HCl$$

$$:CFCl + Cl_2 \longrightarrow CFCl_3$$

Under the sensitization condition, further reactions are possible:

$$CFCl_3 \longrightarrow CFCl_2 + Cl\cdot$$

$$Cl\cdot + CFHCl_2 \longrightarrow HCl + \cdot CFCl_2$$

$$\cdot CFCl_2 + Cl_2 \longrightarrow CFCl_3 + Cl\cdot$$

Thus forms a chain reaction process.

Under our experimental condition, there is a large excess of chlorine gas because the ratio of $CFHCl_2$ to Cl_2 is one-third (or one-fourth). The CFCl or $CFCl_2$ formed reacts further with Cl_2 to produce $CFCl_3$ as a major product.

When comparing the results of chlorination and oxidation, it is obvious that Cl_2 eliminates CFCl better than O_2 because $CFCl_3$ is the only product in chlorination reaction while CF_2O is also present in oxidation.

From the experimental results and discussion above, it can be concluded that quantitative yields of CFClO and $CFCl_3$ can be obtained by laser sensitization to produce CFCl carbene from $CFHCl_2$ and by laser sensitized oxidation and chlorination of $CFHCl_2$. It should be pointed out that, in laser sensitized reactions, the primary products of the reaction can undergo additional sensitized reactions. This fact should not be overlooked.

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12922
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PHYSICAL SCIENCES

ANALYSIS OF MICROPARTICLES BY MONTE CARLO METHOD

[Article by He Yancai [0149 1693 2088] of Shanghai Institute of Silicate [Chemistry and Technology] of the Chinese Academy of Sciences: "Using Monte Carlo Method in Quantitative X-ray Analysis of Microparticles"]

[Text] Quantitative analysis of microparticles is a very important and difficult research subject. This work presented the theory to calculate the x-ray emission intensity of regular particles using the Monte Carlo method.[1] On this basis, a rigorous quantitative x-ray analysis method for microparticles was established for the first time. Assuming I_i^p and I_i^s are the characteristic x-ray emission intensities of element i in the particle and pure element i, respectively, then the composition of element i in the particle is

$$C_i = H \frac{I_i^p}{I_i^s} \qquad (1)$$

H is the particle factor, including atomic number, x-ray absorption, fluorescent effect and effect of geometric dimension and shape of the particle. The intensity $I_i^p/I_i^s (K_i)$ was normalized and used as the first approximation C_i of $C_i^{(1)}$. The Monte Carlo method was used to calculate the intensities $I_i^{p(1)}$ and $I_i^{s(1)}$ for a particle with $C_i^{(1)}$ and a pure specimen. Let us assume that the difference between the actual measured intensity and the first approximation is $\Delta K_i^{(1)}$, then

$$\triangle K_i^{(1)} = K_i - K_i^{(1)} \qquad (2)$$

$\Delta K_i^{(1)}$ may be positive or negative. Assuming $\Delta K_i^{(1)}$ is the first approximation concentration and the increment of $C_i^{(1)}$ is $\Delta C_i^{(1)}$, then the second approximation concentration is:

$$C_i^{(2)} = C_i^{(1)} - \triangle C_i^{(1)} \qquad (3)$$

After normalizing $C_i^{(2)}$, the aforementioned Monte Carlo method was repeated until the nth step in order to satisfy $|\Delta K_i^{(n)}| < \varepsilon$ step by step, where ε is

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a given infinitesimally small quantity. There, $C_i^{(n)}$ is the concentration of the particle sample.

We define the x-ray depth distribution function in an arbitrarily shaped particle as

$$\phi_p(\rho z) = \frac{\text{x-ray ionization cross-section in a thin layer at a certain depth in a particle}}{\text{x-ray ionization cross-section on the surface of a particle exposed to the electron base}}$$

If n is the effective number of electrons captured at the intersection of the large cross-section of the particle and the Gauss electron beam, and N_0 is the total number of incident electrons, then the intensity ratio between the particle and the sample after correction for absorption is

$$K_i = \frac{n \cdot \int_p \phi_{pi}(\rho z) \exp[-\mu_p \rho S(x,y,z)] d\rho z}{N_0 \cdot \int_0^\infty \phi(\rho z) \exp(-\mu \rho z \csc \psi) d\rho z} \tag{4}$$

S (x, y, z) is the x-ray photon absorption path in the particle, which could be solved using the method described in Reference 2.

The Bethe equation was used to describe the inelastic scattering of electrons in a multi-element solid. The scattering cross-section of the ith atom was obtained by integrating the Rutherford differential cross-section with respect to the entire solid angle $r\pi$: $\sigma_i = \left(\frac{Zc^4}{2E}\right)^2 \frac{\pi}{\alpha(1+\alpha)}$. The electron cloud shielding parameter α is $3.4 \times 10^{-3} Z^{2/3}/E$. The total scattering cross-section of the ith atom in the solid is $\sigma_{ii} = \frac{C_i}{A_i} \sigma_i$. The normalized result represents the probability of the ith atom being scattered in a certain elastic scattering incident. The Monte Carlo method was then used to calculate the elastic scattering function $\phi(\rho z)$ of electrons in a solid.[3]

The accuracy of the Monte Carlo method in calculating the $\phi(\rho z)$ function was verified experimentally in the quantitative analysis of microscopic areas in thin films. This technique is based on experiments. In the actual quantitative analysis, it is only necessary to feed the measured intensity ratio K_i into the computer program to calculate the composition of a microparticle.

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PHYSICAL SCIENCES

RESONANCE STRUCTURE IN EXCITED STATE DISCUSSED

[Article by Dai Qianhuan [2071 0051 0958], Zhou Ruzhong [0719 3067 1813] and Shen Xiaodong [3088 2556 2639] of Beijing Industrial University: "The Probability of Homologous Linear and Resonance Structure in the Excited State"]

[Text] We have successfully extended the resonance theory to the quantitative treatment of the excited state of conjugate molecules. The ground state of the conjugate system and the "kekule" count (polar) of the excited state were used as the base vectors. According to Boltzmann distribution, it could be proved that any measureable quantity K related to the quantized energy involving the electronically excited state (such as wave number of the ultraviolet absorption peak, oxidative or reductive polarographic half-tone potential) has a linear relationship with the natural logarithm of the ratio of the excited structure count (ESC) and the ground structure count (GSC), i.e.

$$K = A + B \ln \left(\frac{ESC}{GSC} \right) \qquad (1)$$

where A and B are constants. Actual calculation of benzene polycylic aromatic hydrocarbons (PAH) confirmed the aforementioned theory ($|r| > 0.96$).

We have, at the same time, also successfully applied the above formula to the homologous linear law by Jiang Mingqian [5592 2494 6197]. All the homologs in Jiang's publication, Reference 2, including the wave number of ultraviolet absorption and polarographic half-wave potential, satisfy the above relation. From the first order Taylor series expansion of the above formula, we could prove that the wavelength is approximately linear with ESC/GSC. Out of a possible 464 series for computation, i.e., data on wave number, wavelength, half-wave potential and ionization potential, 360 are rated excellent which is 77.58 percent ($|r| \geq 0.99$). The remaining are good ($|r| \geq 0.95$). GSC was obtained according to Herndon's method.[3] ESC was also obtained using our formula for hydrocarbons[1] when the system contains foreign atoms. ESC was obtained by assuming anions were tied to foreign atoms with the highest electron negativity.

In the normal straight chain alkane series, the first ionization potential E measured by electron collision, photoionization and photoelectron spectrum satisfies the following linear relationship:

$$\ln\left(\frac{ESC}{GSC}\right) = A + B\ \ln E, \tag{2}$$

The correlation is excellent ($|r| > 0.99$). For a straight chain hydrocarbon, GSC≡1. ESC indicates that the positive charges are homogeneously distributed over the C-H and C-C bonds. Therefore, ESC is 3n + 1 (n is the number of carbon atoms). The positive charges are moving between different bonds. There are small energy barriers to overcome. Experience in mass spectrometry shows that this resonance structure indeed exists in hydrocarbon ions. The mutual transformation among polycyclic aromatic hydrocarbons will also overcome certain energy barriers. Hence the aforementioned fact indicates that when a molecule is in its ground state the real structure is statistically a complex body of individual resonance structures. In the excited state, these mechanical resonance structures may actually exist. It is the sum of all individual resonance structures.

All the computations were done by a self-designed least square automatic graph plotting program (LSGRAPH) using BASIC (Shap 1500, four colors).

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PHYSICAL SCIENCES

LASER SCATTERING IN PLASMA EXAMINED

[Article by Lu Quankang [7120 0356 1660], Chen Hang [7115 5725], Yin Qi [1438 3823] and Wang Wenhua [3769 2429 5478] of Fudan University]

[Text] Laser scattering has already become one of the most effective methods to analyze a plasma. The scattering spectrum can be used to obtain information such as electron density, electron temperature, plasma temperature and magnetic field strength in the plasma.

Since Bowles used radar waves to study the ionosphere, many scholars calculated the scattering spectrum based on theory. For example, Rostoker and Rosenbluth gave the fluctuation of the plasma from kinetics and calculated the scattering spectrum with an external magnetic field. However, due to the complexity of the mathematics, the Lorentz force is usually nelgected in the literature.

On the basis of the work of Rostoker and Rosenbluth,[1] this paper gave the laser scattering spectrum in plasma by taking the Coulombic force as well as the Lorentz force into account utilizing a heuristic particle model. It meant that the calculation was made based on the total electromagnetic force interaction between charged particles in the presence of an external magnetic field. The fundamental equations are:

$$\frac{\partial f_\alpha}{\partial t} + v \cdot \nabla f_\alpha + \frac{q_\alpha}{m_\alpha}\left(E + \frac{1}{c}v \times B\right) \cdot \nabla_v f_\alpha = 0 \qquad (1)$$

$$\nabla \times E = -\frac{1}{c}\frac{\partial B}{\partial t} \qquad (2)$$

$$\nabla \times B = \frac{1}{c}\frac{\partial E}{\partial t} + \sum_\alpha \frac{4\pi \bar{n}_\alpha q_\alpha}{c}\int f_\alpha v\, dv + \frac{4\pi}{c}q_T v' \delta(x - x') \qquad (3)$$

where q_α, m_α, and $\bar{n}_\alpha$ are the charge, mass and mean density of the αth kind charged particle, respectively; f_α is the distribution function of the αth kind charged particle; E and B are the strength of the electric and magnetic field, respectively (B includes both internal and external magnetic fields); and x' and v' are the position and velocity of the heuristic particle. In the external magnetic field $B_0 = B_0 e_z$. The heuristic particle moves in a helix around the magnetic line of force:

$$x' = x_0' + a' [\cos(\Omega_\alpha t + \beta) - \cos\beta]e_x + a'[\sin(\Omega_\alpha t + \beta) - \sin\beta]e_y + v_z' t e_z \tag{4}$$

$$v = -v_\perp' \sin(\Omega_\alpha t + \beta)e_x + v_\perp' \cos(\Omega_\alpha t + \beta)e_y + v_z' e_z \tag{5}$$

Here, β is the initial phase, $\Omega_\alpha = q_\alpha B_0/m_\alpha c$ is the spin frequency, and $a' = v_\perp'/\Omega_\alpha$ is the spin radius.

We obtain the structure factor of plasma scattering as:

$$
\begin{aligned}
S(k,\omega) = {} & 2\pi \int f_{eo}(v')dv' \sum_{m=-\infty}^{\infty} \Big| \sum_{j=1}^{3} H_{jm} \\
& + J_m(k_\perp a') \Big|^2 \delta(\omega - [k\cdot v']_m) \\
& + 2\pi \int f_{eo}(v')dv' \sum_{m=-\infty}^{\infty} \Big| \sum_{j=1}^{3} N_{jm}\Big|^2 \delta(\omega) \\
& + 2\pi z \int f_{io}(v')dv' \sum_{m=-\infty}^{\infty} \Big| \sum_{j=1}^{3} H_{jm}\Big|^2 \delta(\omega \\
& - [k\cdot v']_m) \\
& + 2\pi z \int f_{io}(v')dv' \sum_{m=-\infty}^{\infty} \Big| \sum_{j=1}^{3} N_{jm}\Big|^2 \delta(\omega),
\end{aligned} \tag{6}
$$

where f_{eo} and f_{io} are the equilibrium distribution functions for electrons and ions, respectively, J_m is the mth order Bessel function:

$$H_{1m} = \omega_{p\alpha}^2 \frac{v_\perp'\left(\frac{m}{k_\perp a'}\right)J_{-m}A_{11} + iv_\perp' J'_{-m}A_{12} + v_z' J_{-m}A_{13}}{i[k\cdot v']_m D(k, -i[k\cdot v']_m)} \int \sum_n \frac{J_n^2 \frac{\partial f_{\alpha o}}{\partial v_\perp}\left(\frac{n}{k_\perp a}\right)}{i[k\cdot v]_n - i[k\cdot v']_m}dv, \tag{7a}$$

$$H_{2m} = \omega_{p\alpha}^2 \frac{v_\perp'\left(\frac{m}{k_\perp a'}\right)J_{-m}A_{21} + iv_\perp' J_{-m}'A_{22} + v_z' J_{-m}A_{23}}{i[k\cdot v']_m D(k, -i[k\cdot v']_m)} \int \sum_n \frac{J_n' J_n \frac{\partial f_{\alpha o}}{\partial v_\perp}}{i[k\cdot v]_n - i[k\cdot v']_m}dv, \tag{7b}$$

$$H_{3m} = \omega_{p\alpha}^2 \frac{v_\perp'\left(\frac{m}{k_\perp a'}\right)J_{-m}A_{31} + iv_\perp' J'_{-m}A_{32} + v_z' J_{-m}A_{33}}{i[k\cdot v']_m D(k, -i[k\cdot v']_m)} \int \sum_n \frac{J_n^2 \frac{\partial f_{\alpha o}}{\partial v_z}}{i[k\cdot v]_n - i[k\cdot v]_m}dv, \tag{7c}$$

where $J_{-m} = J_{-m}(k_\perp a')$, $J_n = J_n(k_\perp a)$, $A_{ij} = A_{ij}(k, -i[k\cdot v']_m)$;

$$N_{1m} = \omega_{p\alpha}^2 \frac{v_\perp'\left(\frac{m}{k_\perp a'}\right)J_{-m}A_{11} + iv_\perp' J_{-m}A_{12} + v_z' J_{-m}A_{13}}{-i[k\cdot v']_m D(k,0)} \int \sum_n \frac{J_n^2 \frac{\partial f_{\alpha o}}{\partial v_\perp}\left(\frac{n}{k_\perp a}\right)}{i [k\cdot v]_n}dv, \tag{8a}$$

$$N_{2m} = \omega_{p\alpha}^2 \frac{v_\perp'\left(\frac{m}{k_\perp a'}\right)J_{-m}A_{21} + iv_\perp' J_{-m}A_{22} + v_z' J_{-m}A_{23}}{-i[k\cdot v']_m D(k,0)} \int \sum_n \frac{iJ_n' J_n \frac{\partial f_{\alpha o}}{\partial v_\perp}}{i[k\cdot v]_n}dv, \tag{8b}$$

$$N_{3m} = \omega_p^2 \frac{v_\perp'\left(\frac{m}{k_\perp a'}\right)J_{-m}A_{31} + iv_\perp' J_{-m}A_{32} + v_z' J_{-m}A_{33}}{-i[k\cdot v']_m D(k,0)} \int \sum_n \frac{J_n^2 \frac{\partial f_{\alpha o}}{\partial v_z}}{i[k\cdot v]_n}dv, \tag{8c}$$

where $A_{ij} = A_{ij}(k, 0)$;

$$D(k, p) = \begin{vmatrix} I_{xx} - \dfrac{k_z^2 c^2}{p^2} - 1 & I_{xy} & I_{xz} + \dfrac{k_\perp k_z c^2}{p^2} \\[2ex] -I_{xy} & I_{yy} - \dfrac{k^2 c^2}{p^2} - 1 & I_{yz} \\[2ex] I_{zx} + \dfrac{k_\perp k_z c^2}{p^2} & I_{zy} & I_{zz} - \dfrac{k_\perp^2 c^2}{p^2} - 1 \end{vmatrix}, \quad (9)$$

$$I_{xx} = \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{\left(\dfrac{n}{k_\perp a}\right)^2 J_n^2(k_\perp a)}{p + i[k \cdot v]_n} v_\perp \frac{\partial f_{\alpha 0}}{\partial v_\perp} dv , \tag{10a}$$

$$I_{xy} = i \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{\left(\dfrac{n}{k_\perp a}\right) J_n'(k_\perp a) J_n(k_\perp a)}{p + i[k \cdot v]_n} v_\perp \frac{\partial f_{\alpha 0}}{\partial v_\perp} dv , \tag{10b}$$

$$I_{xz} = \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{\left(\dfrac{n}{k_\perp a}\right) J_n^2(k_\perp a)}{p + i[k \cdot v]_n} v_\perp \frac{\partial f_{\alpha 0}}{\partial v_z} dv ; \tag{10c}$$

$$I_{yy} = \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{J_n'^2(k\, a)}{p + i[k \cdot v]_n} v_\perp \frac{\partial f_{\alpha 0}}{\partial v_\perp} dv , \tag{10d}$$

$$I_{yz} = - i \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{J_n'(k_\perp a) J_n(k_\perp a)}{p + i[k \cdot v]_n} v_\perp \frac{\partial f_{\alpha 0}}{\partial v_z} dv, \tag{10e}$$

$$I_{zx} = \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{\left(\dfrac{n}{k_\perp a}\right) J_n^2(k_\perp a)}{p + i[k \cdot v]_n} v_z \frac{\partial f_{\alpha 0}}{\partial v_\perp} dv , \tag{10f}$$

$$I_{zy} = i \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{J_n'(k_\perp a) J_n(k_\perp a)}{p + i[k \cdot v]_n} v_z \frac{\partial f_{\alpha 0}}{\partial v_\perp} dv \tag{10g}$$

$$I_{zz} = \sum_\alpha \frac{\omega_{p\alpha}^2}{p} \int \sum_{n=-\infty}^{\infty} \frac{J_n^2(k_\perp a)}{p + i[k \cdot v]_n} v_z \frac{\partial f_{\alpha 0}}{\partial v_z} dv \tag{10h}$$

where $A_{ij}(k, -i[k \cdot v']_n)$ is the algebraic complementary minor of $D(k, i[k \cdot v]_m)$ and $A_{ij}(k, 0)$ is the algebraic complementary minor of $D(k, 0)$, $[k \cdot v]_m = k_z v_z + m\Omega_\alpha$.

From the scattering spectrum $S(k, \omega)$, one gets:

(1) The shape of the spectrum is the same as the one when only Coulombic interactions are considered. The scattering spectrum is a modulation spectrum comprised of a series of Gaussian curves. The central frequency is $\omega = n\Omega_\alpha$, $n = 0, \pm 1, \pm 2 \cdots$ (where $\omega = \omega_s - \omega_0$, i.e., difference between scattered frequency and incident frequency; $k = k_s - k_0$, i.e., difference between scattered and incident wave vectors).

(2) Different from Reference 2, the intensities of peaks have changed due to the effect of the Lorentz force.

After the numerical value of the structure factor is calculated by a computer, it can be compared to the experimental results.

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APPLIED SCIENCES

OPTIC FIBER APPLICATIONS IN DATA COMMUNICATIONS

[Article by Yu Huaiquan [0205 2849 6898] and Lu Zinan [7120 5261 0589]:
"Optic Fiber Applications in Data Communications"]

[Excerpts] I. Preface

Data communications systems link together computers and terminal equipment
with communications circuits to accomplish information transferral, exchange,
and processing, that is, the so-called "shared resources." This is a new
mode of communications that has developed along with the broader applications
of computers, and is the third large mode of communications continuing upon
analog communications and PCM digital communications, and which has only been
around for 24 years (computers have been around for only about 38 years).

Currently, their applications have reached from industrial and agricultural
production, transportation and shipping, national defense and military matters,
finance and business and scientific research to aspects of education, health,
administration and management, and environmental protection.

Because in aspects regarding low loss, high capacity, security, resistance to
EM interference, and resistance to terrestrial current optic fibers are great-
ly superior to metallic cable, during the mid 1980's optic fiber communica-
tions will become an important communications system. Currently, optic fiber
communications in China have already stepped from the test lab into the stage
of on-site application. And computers themselves and data communications
systems will be the greatest potential users of optic fibers. At present there
are more articles about PCM optic fiber communications, while applications in
computers and articles about applications of optic fibers in data communica-
tions are fewer, especially in China. In 1979 we imported a 20,000 bit per
second optic fiber data link from the American VELTEC Company, and developed
a 1 megabit per second optic fiber data link by analyzing it. To satisfy the
requirements of local computer data communications, we have also recently
developed a 2 megabit per second optic fiber data link. The quality of its
performance effects the speed of real time processing systems and the geo-
graphical scope of shared resources, so it is a key piece of equipment in data
transmission systems.

IV. The Optic Fiber Data Link Used in Local Computer Network Communications

1. Characteristics of a local computer network

Along with the steady increase in the number of computers and the constant expansion of fields of application, computer network technology is not only used to connect computers throughout this country and even the world, but is also for computer links within a department, a city, or a building. From the point of view of distance we can distinguish the two forms of long distance computer networks and local computer networks. The characteristics of local networks are:

a. are usually managed and run by a single organization;

b. geographic range is within a few km;

c. components of a different nature may be linked together, which can include both intelligent equipment like computers and also storage devices like disks and magnetic tape;

d. computer connections are simple and low priced, generally using digital serial transmission.

The following table lists the differences between local computer networks and long distance computer networks.

Table of Differences Between Local Computer Networks
and Long Distance Computer Networks

	Local Networks	Long Distance Networks
distance (km)	0.1 ~ 10	>10
rate of transmission (megabits per second)	10 ~ 0.1	<0.1
network reaction time	100 microsecond range	100 millisecond range
Linked components	computers or intelligent equip. and storage devices	computers or intelligent equipment

2. Chief technical indexes of the system and flowcharts

Chief technical indexes for the system are:

operating mode:	completely duplex
synchronization mode:	start stop mode
code type:	NRZ
efficiency of LED entry into optics:	$\tilde{P}_0 > 50$ microwatts (-13 milliwatt dB)
receiver sensitivity:	PIN $\bar{P} = -43$ milliwatts dB;
	APD $\bar{P} = -62$ milliwatts dB (calc)

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error code rate: 10^{-9}

code speed: 50 bits per second ~ 2 megabits per second arbitrary code speed

dynamic range: 20 dB

The system flowchart is shown in figure 3.

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 ─┐─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  activity   ┬ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
  |                       | connectors |                                |
  |                       |   /    \   |                                |
  |                       | /        \ | photodetector── main── detector──|
 data──┬─>shaping───>drivers/          \| and pre-amp    ─> amp ──        |
  |              ↑      LED             |        |        |               |
  |              |                      | optic fiber |        |          |
  |              |                      | or cable   |feedback|           |
  |              |                      |                                 |
  |              └─────────────┐        |                                 |
  |                            |        |                                 |
  |                            |        |                                 |
 tele─    ──>  current/   ──> reverse   |                                 |
 type         voltage        phase      |                                 |
 input        converter                 |                                 |
                                        |                                 |
                          |   data out  |<────────────────────shaping─────┘  |
                          |             |                                 |
   |                      |             |                                 |
 ──┬──────────────────────┘             |                                 |
                                        |                                 |
   transmitter            to        <───────────────voltage/current       |
                          tele─      |                    converter        |
                          type       |                                     |
                                     |─────────────────────────────────────|
                                     |          receiver
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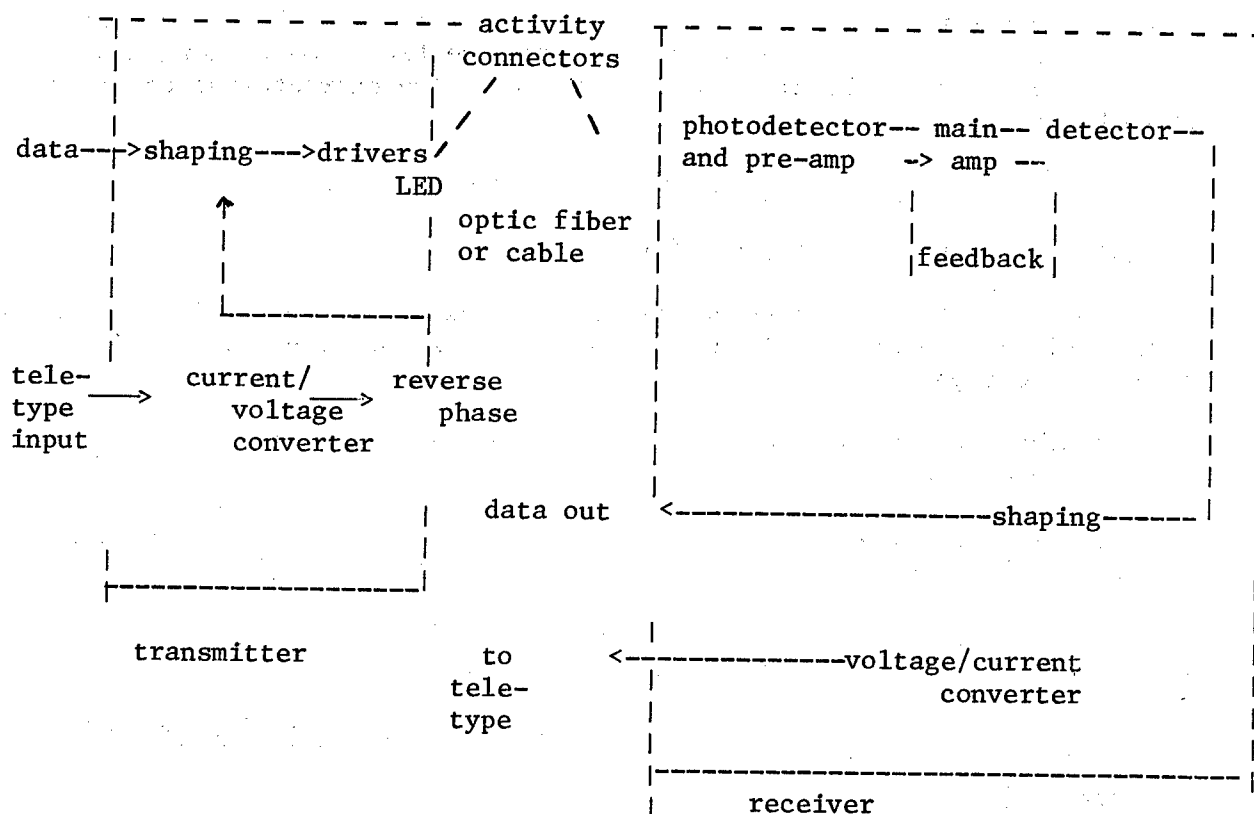
3. Regarding light source considerations

Light sources from which to choose are the three types of lasers, side emitting LED, and surface emitting LEDs. LDs are fast reacting and powerful, but require APC circuits and sources for electric lines, which is complicated. From the point of view of the local computer networks, too, we do not necessarily want to use LDs. Edge emitting LEDs are a more ideal light source, convenient to use, powerful, and the modulation bandwidth can be about 50 MHz, but it is difficult to get them at present. The modulation bandwidth for LEDs is only about 20 MHz and they have a uniform output power of -13 milliwatts dB. In general, using LEDs can satisfy requirements.

4. Selection of optic fiber bandwidths

Optic fiber is a dispersion channel, and of types of optic fiber dispersion there are multiple mode dispersion ($\Delta\tau_M$), material dispersion ($\Delta\tau_m$), and waveguide dispersion ($\Delta\tau_W$). Ordinarily, with short waves, waveguide dispersion is much less than material dispersion, so $\Delta\tau_W$ may be ignored and not calculated,

considering only multiple mode dispersion $\Delta\tau_M$ and material dispersion $\Delta\tau_m$. Ordinarily what we mean by the optical fiber bandwidth is when LDs are used as light sources, and LDs are a narrow spectrum light source (σ_s=1 millimicron), so the bandwidth is chiefly restricted by $\Delta\tau_M$. After transmission through several hundred meters, the response pulse shape approaches the bilaterally symmetrical Gaussian-type, that is,

$$Q(z,\ t)=Q_0^2\sqrt{\frac{\pi}{Tt}}\left(\frac{t}{r_{\infty}zT}+\frac{1}{2}\right)^{-1}$$

$$\cdot\exp\left(-\frac{r_{\infty}^2z^2T}{4t}-\frac{t}{T}\right) \qquad (1)$$

In the equation, $T-n_{1/2cA}=(n1/2c)(Q0/r\infty)^2$, where Q0 is the distribution breadth of a mode under stable conditions, where $r\infty$ is the loss constant under stable conditions, where n_1 is the fiber core refractivity, and where c is the speed of light in free space. Therefore, we have a conversion relation for the Gaussian pulse breadth and the optic fiber bandwidth

$$\Delta\tau_M=\frac{0.53}{BW_f} \qquad (2)$$

If for each km the optic fiber bandwidth BW_f is 250 MHz or 500 MHz separately substituted in expression (2), we can get $\Delta\tau_M$ as 2.12 nanoseconds/km or 1.06 nanoseconds/km.

Let us look again at the size of the material dispersion. The material dispersion parameter M-100 picoseconds/millimicron km, and the typical spectral linewidth is σ_s=30 millimicrons. Therefore, $\Delta\tau_m=\sigma_s M=3$ nanoseconds/km.

If the distance of transmission is calculated at 5 km, then

$$\tau_{M5}=\sqrt{5}\,\Delta\tau_M=\begin{cases}4.74\,\text{nanoseconds}\\2.37\,\text{nanoseconds}\end{cases}$$

$$\tau_{m5}=5\Delta\tau_m=15\,\text{nanoseconds}$$

$$\tau_{M5}=\sqrt{\tau_M^2+(\tau_m+\tau_w)^2}\approx\sqrt{\tau_M^2+\tau_m^2}$$

$$=\begin{cases}15.73\,\text{nanoseconds}\\15.18\,\text{nanoseconds}\end{cases}$$

It can be seen from the above that whether or not the bandwidth of each km of optic fiber is 250 MHz or 500 MHz, overall dispersion chiefly depends on material dispersion, and the following is calculated with a reference of 15.73 nanoseconds, from which we obtain the 5 km optic fiber bandwidth

$$BW_{f5}=\frac{0.53}{15.73}\times1000=33.7\,\text{MHz}$$

The overall bandwidth

$$BW_5 = \left(\frac{1}{20^2} + \frac{1}{33.7^2}\right)^{-\frac{1}{2}} = 17.2 \text{ MHz}$$

similarly we can calculate the overall bandwidth at 9 km

$$BW_9 = \left(\frac{1}{20^2} + \frac{1}{19^2}\right)^{-\frac{1}{2}} = 13.8 \text{ MHz}$$

5. Estimating receiver sensitivity

First, we must determine the receiver bandwidth. When the optic fiber distance is short, corresponding dispersion is also short, as the signal bandwidth is the broadest. The first null point bandwidth of a 10 megabits per second rising cosine wave is also 20 MHz. Of course, the actual frequency spectrum is not that broad because of limitations in the LED bandwidth. However, we want to try hard to decrease pulse distortion in start-stop mode asynchronous transmission, so the receiver bandwidth is fixed at 20 MHz.

In this way, by calculating circuit noise

$$\langle i_c^2 \rangle^{1/2} = 4.9 \text{ nA}$$

$$\text{sensitivity } \eta \tilde{P} = \frac{h\nu}{q} Q \langle i_c^2 \rangle^{1/2}$$

In the equation, η is the quantum efficiency, $\tilde{P}$ is the incident peak power, h is the Plank constant, ν is the optical frequency, and Q is the amount of electronic charge. We can calculate

$$\eta \tilde{P} = 1.48 \times 6 \times 4.9 \times 10^{-9} = -43.6 \text{ milliwatt dB}$$

6. Regarding the estimation of transmission distances

If we choose an optic fiber loss of 4.5 dB/km (including junction dissipation), loss for moving connectors of 1 dB, 0.5 dB loss at each fixed weld, and also take η=0.5, to be 0.5, then the overall loss L_t is

$$L_t = 0.5 \times 2 + 4.5 \times 5 + 3 = 28.5 \text{ dB}$$

while the maximum allowable loss is

$$L_m = -13 - (-43) = 30 \text{ dB}$$

still with 1.5 dB overmeasure.

7. Experimental results

This system carried out high speed data transmission through a CAMAC interface on a DJS-131 computer at a rate of 1 megabits per second with an optic fiber length of 1.6 km, with which we had good test results. We also used a DMC11 interface on a PDP11/34A with optic cable (350 m) looping transmission data at a rate of 1 megabits per second, testing over and over again for 5 days during normal operation of the machine, and also used a sampling storage oscillograph to photograph the input/output wave forms at the interface. Figure 4 [not reproduced] shows the input/output wave forms using 350 m (metallic) cable and optic cable. One can see that during high code rate data transfers and using 350 m optic cable to substitute for (metallic) cable of the same diameter, the wave form is obviously better. At the same time we did an experiment transferring documents between two PDP11/34A's, under normal machine operations, where for 4 hours of continuous operation there were no errors. In addition, this setup transmitted for 10 hours between TP801 single board computers at a rate of 7.8 megabits per second without error. Finally, we also did a communications experiment between a DJS-053 microcomputer development system and a DJS-033 microcomputer, with good results.

V. Conclusions

Since the American semi-automatic SAGE air defense system went into operation in 1958, data communications in developed countries have grown extremely quickly, and there are not only national data communications networks, but also national defense data communications networks set up through communications satellites or undersea cables. In large scale networks, like the American ARPA network for shared computer resources developed for the Department of Defense by the Office of High Level Research and Planning, the international commercial GE network, as well as the SITA network of international aviation companies, all of which are quite well known. Currently, whether a country has a national data communications network has already become an important index of a nation's technological level.

China's data communications are just getting started, and directions for development and questions of distribution ought to elicit attention and discussion by relevant departments. From the point of view of our experience, using optic fiber for a transmission medium in local computer networks is already technically feasible, and performance is superior to metallic cable. If optic fiber is to be the connections within a computer or between computers and their peripherals, then we must develop integrated, small optical-electrical converters or active junctions with the cooperation of relevant departments.

APPLIED SCIENCES

EXPERIMENTS WITH DOMESTIC IC SUBSTRATES

[Article by Guan Shuzhu [7070 2885 2691] and Li Dunfu [2621 2415 1788]:
"Advanced Production of the Millimeter Wave IC Substrate"]

[Text] I. Introduction to Millimeter Wave ICs.

In pace with developments in millimeter wave precision guided tactical weapons
there has come the requirement to develop low cost, highly reliable IC cir-
cuits. Forms for such circuits that have been proposed are: microstrip
circuits, waveguide surface circuits, fin-line, and dielectric waveguides.

Millimeter wave microstrip circuits require a medium with low dissipation and
a low dielectric constant, as with the use of quartz substrate. In order to
increase reliability, one expects the thickness to be greater, but to keep
resistance at 50 ohms the guide strip needs to be wider. It is possible that
this will reach a degree of magnitude of a quarter-wavelength, which not only
creates problems for analysis and calculations, but also produces the problems
of higher order modes and radiation. Therefore, the general requirement is
for a thickness of 0.2 millimeters. But in the requirements for high relia-
bility this is clearly not permissible.

Waveguide surface circuits have already been used successfully in the X-band.
The chief problem here is that there is only one conductor line, so active
devices and bias circuits are not easy to make.

Dielectric waveguides have been used successfully in the millimeter band. The
primary problem here is the incompatibility introduced by the single guide-
strip with active devices, and the transient conversion from square waveguides
is also too long.

Fin-lines have attracted people's attention due to their characteristics of
moderate transmission loss, convenient transition, variable circuit modes
(ridge line, trough line, coplaner lines, and waveguide microstrips), multiple
guide strip compatibility, and especially the convenience of installation with
active devices.

Fin-lines require the use of dielectrics that have low dissipation, high reliability, and are homogenous. China does not yet produce such a substrate. With the assistance of the Shanghai Plastics Research Institute we designed, calculated, and tested several substrates, and also used them to develop 8 mm IC frequency mixer and local oscillator modules.

II. The Structure of Fin-line Substrates

Fin-lines can act as basic IC transmission lines. The chief requirements for the substrate for this kind of transmission line are as follows:

1. Low dissipation. In the millimeter wave band, the dissipation angle $tg\delta$ ought to be smaller than from 4 to 10 X10-4. Materials from which to choose include: polytetraflouroethylene, quartz, polystyrene, and ceramic.

2. A low dielectric constant. A low dielectric constant allows greater dimensional tolerance and does not produce higher order modes in greater thickness or when resistance is low. This eliminates the use of a ceramic medium.

3. Better mechanical strength and stability. In the 8 mm waveband, the thickness is generally about 0.2 mm. This requires flexibility without distortion, with at least no distortion below 200 degrees Centigrade. Polystyrene cannot meet this requirement.

4. Better adhesion to metals (adhesives cannot be used). Polytetraflouroethylene does not easily adhere to metals, but instead must be processed without increasing dissipation. Evaporation and metallizing techniques may be used.

5. Low manufacturing cost, technique uncomplicated. Techniques for circuit manufacture should not be complicated, as well. Quartz substrate can be ground to 0.2 mm, but the cost is great and the reliability cannot be ensured. Neither is it easy to manufacture with waveguide clamping holders.

It can be seen from this that there is currently no single material that can simultaneously satisfy the above requirements.

A fortified polytetraflouroethylene circuit substrate has been developed abroad (the American Rogers Company's RT/Duroid 5880) in thicknesses of 0.25 mm (8 mm wave band) and 0.125 mm (3 mm wave band). We do not have this substrate, nor do we have a material of this kind in China. Using existing materials and techniques, the Shanghai Plastics Research Institute has trial manufactured three kinds of substrate, data for which is as in figure 1.

Table 1. Data on Circuit Substrates

Model	BJT	TBS	AT
material	glass fiber infused polytetra-flouroethylene	polytetra-flouroethylene with glass fiber core	pure polytetra-flouroethylene
amount of polytetra-flouroethylene	50%	80%	100%
dielectric thickness (cm)	0.2	0.35	0.30
copper foil thickness (cm)	2 X 0.05	2 X 0.05	2 X 0.05
δr	2.8	not measured	2.25

The results of measuring the transmission loss with these three substrates in the 8 mm band are shown in figure 1.

In figure 1, numbers 1 through 3 are the transmission losses for the BJT substrate, in which number 1 is photomeson loss in a square waveguide. Numbers 2 and 3 are the losses for two samples (fin-line) in waveguides, including transient losses at both ends. What we can tell from these three lines is that: 1. losses come primarily from the dielectric, loss for each cm being about 0.1 dB; 2. losses in the transient band of fin-line waveguides is not great, being roughly equivalent to loss from a dielectric waveguide of the same length or fin-lines; 3. performance of different strata are nearly the same. Numbers 4 through 6 are the fin-line transmission loss for the AT substrate. Number 4 is the dielectric loss. Number 5 is copper ridge line loss (copper stratum thickness of 0.2 mm). Number 6 is the dielectric fin-line loss. Loss under all three conditions is quite small, being about from 0.02 to 0.03 dB per cm, which is already out of the range of the testing system. Obviously, the fin-line metallic loss is slight. Numbers 7 and 8 are the transmission losses for TBS (the core substrate). The results are close to those of BJT losses, but the thickness is not the same, the former being 0.35 mm and the latter 0.2 mm, from which we can deduce that losses for the TBS stratum will be less than for the BJT.
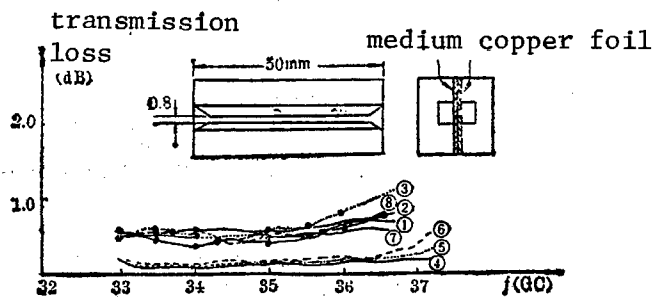
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Figure 1. Results of transmission loss measurements for fin-lines

Waveguide dimensions: 7.11 X 3.56 mm
Medium thickness: numbers 1 to 3 are 0.2 mm, BJT
                       numbers 4 through 6 are 0.3 mm, AT
                       numbers 7 and 8 are 0.35 mm, TBS
                       copper foil is 0.05 mm

Results of tests show that losses in pure polytetraflouroethylene are very small. Further research has shown that losses in these three substrates are rather objective for expanded fin-line or other low resistance lines, the reasons for which is that metallic dissipation at this time has already become the chief component, while copper foil processing and adhesive materials lead to a dramatic increase in loss. If we are to reduce losses we must improve techniques in substrate manufacture.

The mechanical characteristics of these three substrates are listed in table 2. It is obvious that the mechanical characteristics of the pure polytetraethylene substrate are the most deficient, and that it cannot be used. The mechanical capabilities of the BJT substrate are very good, but dissipation is too great, and the dielectric constant is excessive. We have already redesigned a substrate structure to obtain a compromise, shown in figure 2.

Table 2. Mechanical Characteristics of Various Fin-lines

name of substrate	distortion	uniformity of thickness	metal adhesion	loss (dB/cm)
infused substrate (BJT)	none	excellent	excellent	0.1
core substrate (TBS)	none	not uniform	inferior	0.1
pure plastic (AT)	serious	not uniform	inferior	0.02

0.02~0.03mm 铜箔 (A)
（最好镀金）
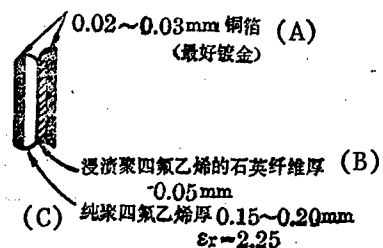
浸渍聚四氟乙烯的石英纤维厚 (B)
0.05mm
(C) 纯聚四氟乙烯厚 0.15~0.20mm
εr=2.25

Figure 2. Newly designed substrate structure
Overall thickness tolerance < ±0.02 mm

Key:
    A. 0.02 to 0.3 mm copper foil (best gold plating)
    B. thickness of quartz glass fiber infused polytetraflouroethylene 0.05 mm
    C. thickness of pure polytetraflouroethylene 0.15 to 0.20 mm $\Sigma_r = 2.25$

We estimate the dielectric constant of this substrate to be about 2.5, dissipation per cm to be about 0.03 dB, and that the mechanical characteristics will be quite good. The copper foil in the right of the figure is a circuit diagram and the left side is the ground plane. The Shanghai Plastics Research Institute has already begun test manufacturing of non-woven fiber substrate. It is estimated that in small batch production the cost of this substrate is about 0.2 yuan per square cm (RT/Duroid 5880 of the American Rogers Company is $60.00 per wafer).

In comparison, quartz substrate ground to 0.2 mm and put on metal by evaporation can cost from 20 to 40 yuan per square cm. Obviously, millimeter wave fin-line ICs are an extremely inexpensive product.

III. The Effects of Fin-line Metallic Thickness and Dielectric Constants on Transmission Characteristics

Presently, foreign countries are generally using the Rogers Company RT/Duroid 5880, which has a dielectric constant of 2.20, a metallic thickness of t=0.017 mm, and a medium thickness of d=0.254 mm. For the substrate in advanced production at the Shanghai Plastics Research Institute, the Σ_r is about 2.8, t is about 0.05, and d=0.2 mm. In designing circuits we must know to use the equivalent dielectric constant $\Sigma_e = (\lambda/\lambda_g)^2$. We use the finite element method and the field matching method to calculate the relevant data for the domestically produced substrate. We will now discuss the relevant results.

Figure 3 shows the effects of substrate metal thickness (t) on transmission characteristics. When the thickness cannot be ignored transmission characteristics are somewhat distorted. After designing with the new substrate we must recalculate all transmission characteristics, which will be a lot of work.
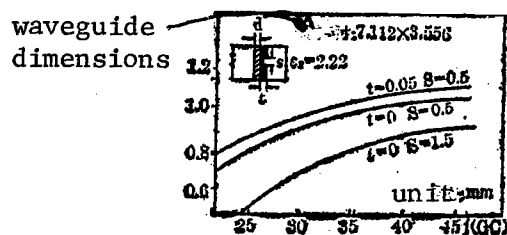
Figure 3. Effects of metallic thickness

Substrate dielectric materials are not the same, and they have a rather great effect upon transmission capabilities. Figure 4 diagrams the results of dispersion characteristics measurements. In the figure, curved lines A and C are the parameters for the domestically produced glass fiber polytetraflouroethylene substrate, and curved lines B and D are the parameters for pure polytetraflouroethylene substrate. Waveguide and substrate dimensions are the same as in figure 3.
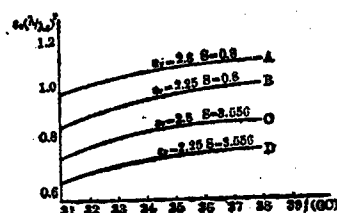

Figure 4. Dispersion characteristics of the domestic substrate (measured)

IV. The Characteristics of Millimeter Wave IC Local Oscillator and Frequency Mixer Modules

We developed an 8 mm wave IC local oscillator, frequency mixer module from the domestically produced glass fiber polytetraflouroethylene substrate discussed above. Figure 5 is a photograph of the actual objects. The one on the left is a complete IC with balanced mixer, local oscillator, and pre- and intermediate amplifiers, all on a piece of 22 X 46 (mm) substrate. The one on the right has balanced mixer and local oscillator modules without the pre- and intermediate amplifiers, and its substrate dimensions are 20 X 20 (mm).
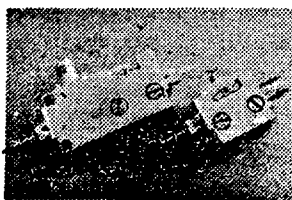

Figure 5. Eight millimeter wave IC receiver module

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This component uses discrete component semiconductor diodes and directly solders a pair of packaged diodes of similar performance onto an IC substrate. After an accelerated test of 20,000 g of impact, performance distortion of the module is very slight. This shows that the structural performance of the IC module is completely dependable. Currently, this module has been serialized and has undergone experimental checkout and long-term operation in various 8 mm radars and airborne remote sensing radiation instruments, performance for which is as in table 3.

Table 3. IC Millimeter Wave Module Performance

type		central freq. (kHz)	band width (MHz)	NF*DSB (dB)	standing wave ratio (VSWR)	temp. coefficient (MHz/Cel.)	dimensions (mm)
freq. mixer	narrow band	33~38	400	4±0.5	<1.6		20X22X20
	broad band	33~38	1000	5+0.5	<2		20X22X20
freq. mixer-local	narrow band	33~38	400	4±0.5	<1.6	**-1.5	20X40X20
osc. module	broad band	33~38	1000	5.5+0.5	<2	**-1.5	20X22X20
	stabilized broad band	33~38	1000	5.5+0.5	<2	-0.1	20X40X20
freq. mixer-pre-inter-amp.-local	narrow broad band	33~38	1000				20X40X20
	broad band	33~38	4000	in advanced production			20X22X20
osc module	stable broad band	33~38	4000				20X40X20
freq. mixer-pre&inter-amplifier (Alpha Co.)		32~40	2000	4			
freq. mixer-pre&inter-amplifier (H-Spacekour Co)		32	31800~32500	3.5			20X30X60

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Notes: *characteristics of externally connected pre&intermediate amplifiers are fIF=30 MHz, NIF=1.3 dB (narrow band model) or fIF=10~550 MHz, NIF=2 dB (wide band model)
**the large temperature coefficient is to match the temperature coefficient of the domestically produced magnetron

We have also provided in the table characteristics of high level products from abroad. There are two indexes in which the domestic module has not yet reached the level of the foreign products. That the frequency band is rather narrow is due to the limitations of the devices and circuit designs; the noise coefficient is some 0.5 to 1 dB higher. We believe that if we use diodes of excellent performance and low noise intermediate amplifiers, we can make the performance of the domestic millimeter wave IC module approach the highest standards abroad.

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APPLIED SCIENCES

BLR STUDIES ON CONIC MODEL WITH LDA IN FL-1 WIND TUNNEL

Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese No 6, Jun 85 pp 9-10

[Article by Zhong Zhan [0112 2069] and Yu Yong [0827 3057]]

[Text] In a cooperative effort between the Shengyang Aerodynamics Research Institute of the Chinese Academy of Aeronautical Research and the Royal Aeronautical Institute of Sweden, an experimental study of boundary layer velocity measurement over a cone using laser (LDA) was conducted in 1984 in the FL-1 wind tunnel of the Shengyang Aerodynamics Research Institute. In this study, velocity distributions at two cross-sections of the boundary layer of a 20° conic model under different Mach numbers are measured. The measured results are in good agreement with theoretical calculations.

Wind Tunnel and Experimental Model

The experiment was performed in the FL-1 intermittent, half-return, trisonic wind tunnel. The test section is 600 mm x 600 mm, and the test Mach numbers are respectively 0.5 and 4.0. The test model is a 68 mm diameter, 700.4 mm long 20° cone. In this test, the angle of attack and the yaw angle of the model are both zero. The dimension of the model and its installed configuration are shown in Figure 1.
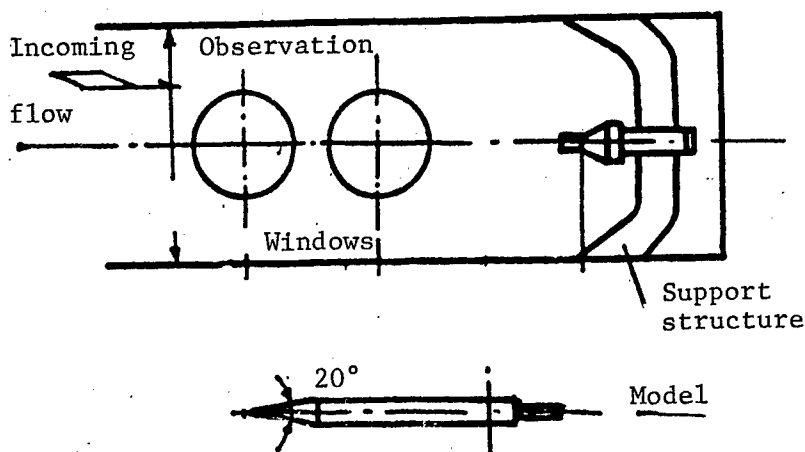

Figure 1. Test Section of the FL-1 Wind Tunnel (Top)

Particle Injection Technique

Because of the air purification treatment in the wind tunnel, particles required for LDA measurement must be injected manually during the test. After a large number of preliminary tests and considerable research, it was decided to place a flexible tube with an outside diameter of 12 mm and an inside diameter of 6 mm at the center of the exit section of the forward chamber; the mouth of the flexible tube is carefully adjusted so that the ejected particles will reach the intended locations of measurement on the model surface. The results are quite satisfactory. In addition, a method is also developed to inject ethyl ether vapor particles onto the model surface, with equally good results.

The LDA System and Measurement Technique

The measurement system used in this experiment is the LDA 10 system, built by the DISA Co; it uses the techniques of backward scattering and co-axial reception. In addition, a two-dimensional movable coordinate frame with a resolution of 0.1 mm has been modified to be a three-dimensional system to provide the capability of measuring any point within the test section. In order to achieve high signal strength and to insure single-mode laser output, the operating power of the laser is chosen to be 1.7 watts. Also, to suppress interference, the opposite window is painted black, and the beam axis is oriented 1.9° from the normal to the window. The light spots are arranged as shown in Figure 2.
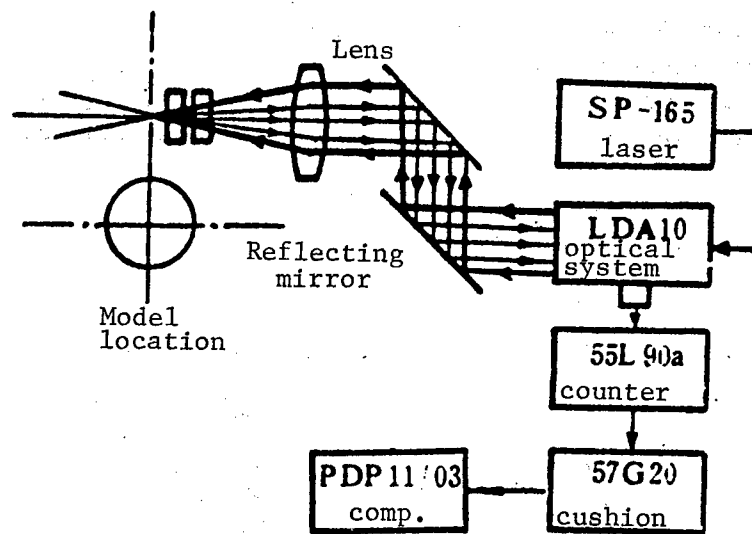

Figure 2. The LDA System

Because the blue light fails to provide good signals, only the green light of the LDA system is used. The experiment also involves signal processing and real-time data processing.

Test Results

At M = 1.2, the measured one-dimensional velocity distributions of the boundary layer at 300 mm and 349 mm from the forward tip of the model are shown in Figures 3 and 4. At M = 0.7, the measured boundary layer velocity distribution at 349 mm from the tip is shown in Figure 5, where Y is the vertical distance from the model surface.
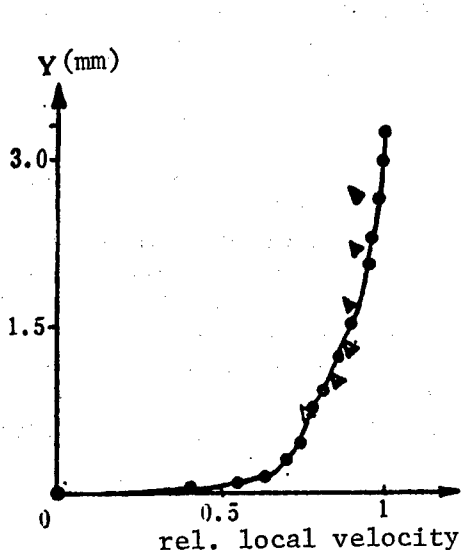
o – calculated result
Δ – experimental result

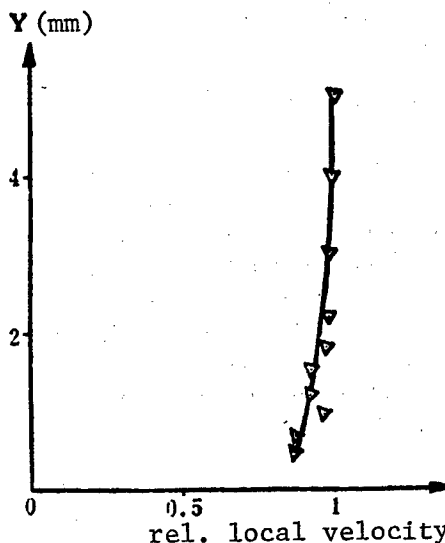Figure 3. Boundary Layer Velocity Cross-section at the Front Station (M = 1.2)

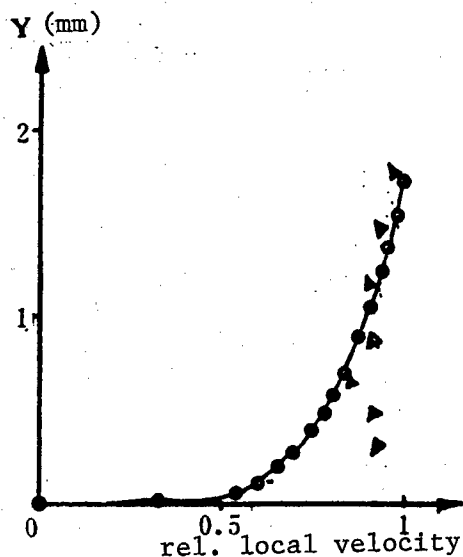Figure 4. Boundary Layer Velocity Cross-section at the Back Station (M = 1.2)

Figure 5. Boundary Layer Velocity Cross-section at the Back Station (M = 0.7)

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By comparing the results, one can make the following observations: 1) At M = 0.7, the measured results are in good agreement with calculated results; at M = 1.2, the two results are in good agreement at distances greater than 0.7 mm from the model surface, but near the model surface the agreement is rather poor. 2) At M = 1.2, at 349 mm from the tip, it is difficult to make theoretical calculations due to the interaction between the boundary layer and shock waves, so only measured results are reported. Because of the good repeatability of the measured values, they can be used as valuable data for the theoretical research of the problem of boundary layer/shock wave interaction.

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APPLIED SCIENCES

MEASUREMENT OF 1 NANOSECOND WIDE BEAMS FOR 2.5 MeV PROTON ACCELERATOR

[Article by Yang Jiayou [2799 1367 0645], Li Wenxue [2621 2429 1331] and Li Jiarong [2621 1367 2837], Institute of Nuclear Science and Technology, Sichuan University: "Measurement of Beam Bursts With Width of 1 Nanosecond for a 2.5 MeV Proton Electrostatic Accelerator"]

[Text] [English abstract] A method and a system of measuring beam bursts with extremely narrow width of 1 ns for a 2.5 MeV proton electrostatic accelerator are described. The results of measurement are given. The system consists of a long coaxial target (wideband Faraday cup), a sub-nanosecond pulse amplifier ($t_x < 0.4$ ns) and a sampling oscilloscope (Type SQ10). Finally, an emphasis is given to the fact that secondary emissions from the target knocked by the beam have almost no effect on the waveform of the beam pulse.

I. Introduction

For measuring beam bursts of a pulsed ion accelerator the beam burst receiving target with a sampling oscilloscope (sometimes with a wideband pulse amplifier inserted in front of the oscilloscope) method is generally used[1,2]; the method of using a definite mode to obtain time pulses related to beam burst start and stop and carrying out analysis with a time-amplitude converter with a multi-channel analyzer is also used.[3] The former method is simple and economical. In this paper we used this method to measure 2.5 MeV proton electrostatic accelerator beam bursts 1 ns wide. The block diagram of the measuring device is illustrated in Figure 1.
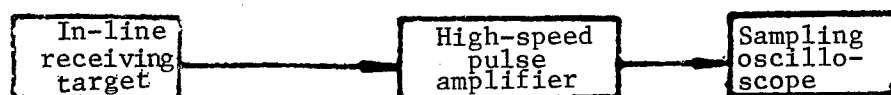
```
┌──────────┐        ┌──────────┐        ┌──────────┐
│ In-line  │        │High-speed│        │Sampling  │
│receiving │────────│  pulse   │────────│oscillo-  │
│ target   │        │amplifier │        │scope     │
└──────────┘        └──────────┘        └──────────┘
```

Figure 1.

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II. Measurement Device

2.1 In-line Receiving Target

Ion accelerator beam burst receiving targets are divided into two kinds: the in-line target (wideband Faraday cup)[1] and the disk target.[4] The former can screen space electrostatic radiation and thus is suited to relaying narrow pulses, but it is complex in structure; the latter is simple in structure, but it cannot screen space electrostatic interference. This device uses the in-line target. Its structure is illustrated in Figure 2.
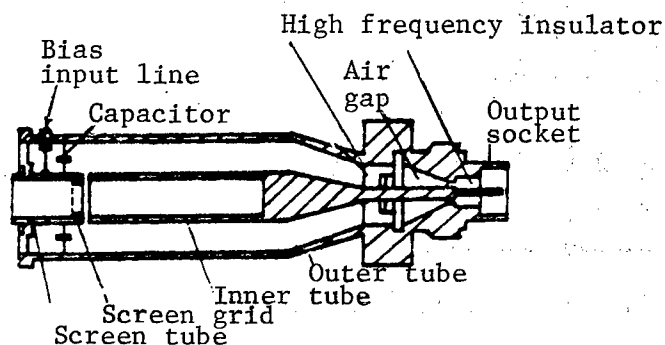

Figure 2. Diagram of In-line Target Structure

By including a screen grid and screen tube the "capacitance effect" elongating the leading edge of the pulse on the target can be avoided. The inner tube is 70 mm deep, sufficient to avoid the influence of secondary target radiation on the beam wave form. The grid applies several tens of volts of positive bias to the target to overcome the contribution of secondary target and grid radiation to average flow strength. Between the screen tube and ground are connected in parallel (symmetrically arranged) four 2400 pF mica capacitors to stabilize the ground potential of the screen tube (grid). The grid is made of ϕ0.1 mm tungsten woven screening, with about 30 openings, capture and loss of the beam through it can be corrected.

Characteristics impedance of the in-line target is designed to be 50 Ω, to match the radio frequency in-line cable.

2.2 High-speed Pulse Amplifier

On the basis of the principles of the transistor series-parallel negative feedback amplifier level mismatch connection,[5,6] we consulted the characteristics of the circuits of J.K. Millard[5] and J. Rush,[7] and developed a subnanosecond pulse amplifier. For a diagram of the circuit principles see Figure 3.

The amplifier input level transmission conductance is $1/(R_e+r_e)$, the intermediate amplification level transmission impedance is R_f, the total current amplification multiple is $R_f(R_e+r_e)$.
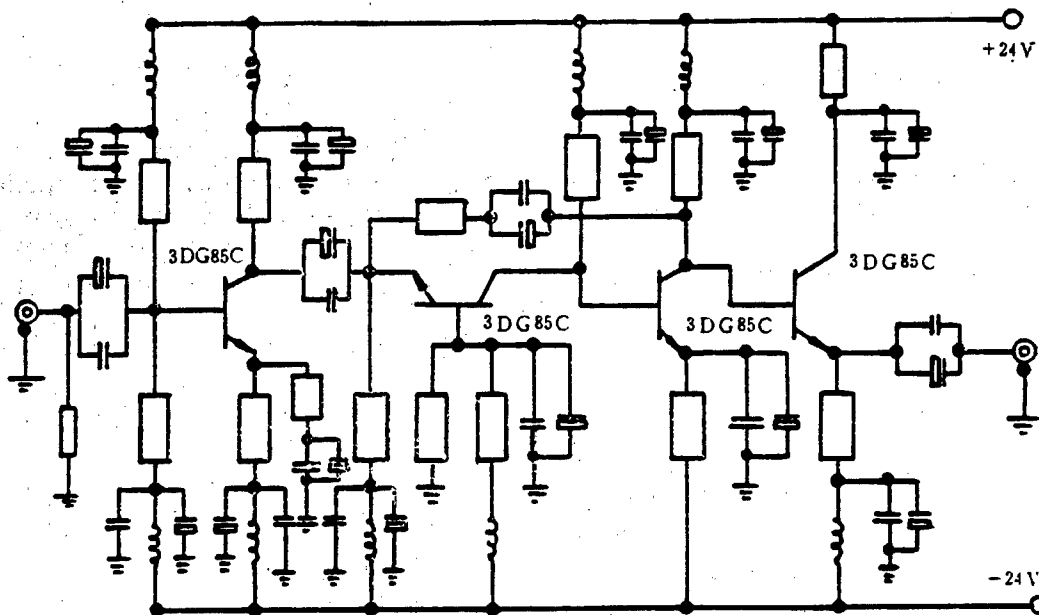
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Figure 3. Diagram of Principles of Subnanosecond Pulse Amplifier

The main measured performance norms of the amplifier are: amplification about 10-fold; rise time $t_r \leqslant 0.4$ ns; overshoot $\leqslant 5$ percent; output dynamic range ±500 mV.

The in-line target, 20 m long SYV-50-5 radio frequency in-line cable, subnanosecond pulse amplifier and sampling oscilloscope SQ10 are connected together in that order. The entire system's rise time after compensation reached 0.5 ns, and the overshoot was still less than 5 percent.

III. Measurement and Results

3.1 Elimination of Interference From High Frequency Mechanical Electromagnetic Radiation

The current pulsed proton electrostatic accelerator uses a Mobely magnetic focusing method.[8] On the high frequency deflecting place in front of the Mobely magnet, the frequency transmitted by the high frequency machine (15 kW) is a 12 MHz, peak value 0-45 kV adjustable sine deflection voltage. The deflection place was about 3 m away from the measurement target, and when the deflection voltage peak was 7 kV, powerful electromagnetic radiation invaded the measurement system, interference waves of 12 MHz with peaks as large as 80 mV were displayed on the oscilloscope. After SYV-50-5 radio frequency cable was adopted as the measurement cable and a copper wire grid screen was adopted for the deflection place signal input terminal, the deflection voltage was 7 kV, the interference wave peaks dropped to 14 mV, and when the deflection voltage was 5 kV, the interference wave peaks were about 10 mV.

3.2 Typical Measurement Results

When the high frequency machine was not yet working, the beam burst was deflected through the Mobley magnet, and the pulse obtained at the target was $t_u = 19$ ns, $U_m = 44$ mV. When the high frequency machine output was about 5 kV, after the beam was compressed by the Mobley magnet, the pulse at the target was $t_u = 1.3$ ns (deducting for the contribution of the measurement device rise time), $U_m = 380$ mV, the corresponding current $I_m = 840\mu A$. For photographs of the waveform, see Figure 4.

3.3 Influence of the In-line Target Successive Emission Effect

The experimental circuits for measuring target successive emissions is illustrated in Figure 5. The experimental conditions were: proton beam energy of about 1.5 MeV, pulse beam width 13 ns, uncompressed by the Mobley magnet.
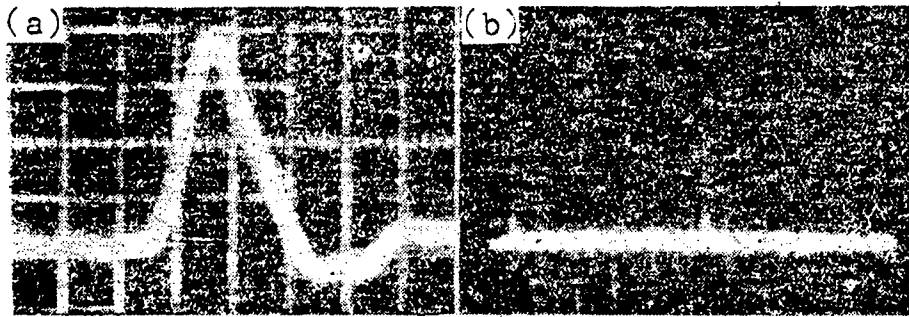

Figure 4. Beam Burst Wave Forms

(a) y axis 100 mV/div,   (b) y axis 100 mV/div
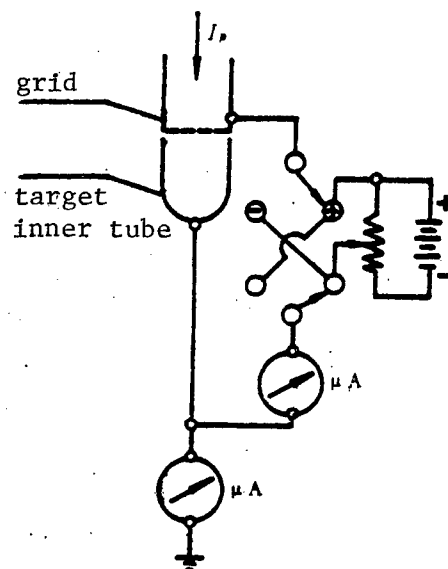   x axis 1 ns/div   x axis 100 ns/div

Figure 5. Target Secondary Emissions Test Circuit

Taking into account the fact that when the proton beam flow bombards the metallic target, not only are there successive electron emissions, but at the same time it is also accompanied by successive positive ion emissions[9]; and also taking into account the fact that the grid had a capture effect and a successive emission effect, from the test data we found the absolute value of the secondary emissions (the sum of the secondary electrons and the secondary positive ions) under the bias potential of the grids (to target) and the ratio of the average current strength relative to the beam flow, and drew a curve of this ratio relative to the grid bias voltage (Figure 6).
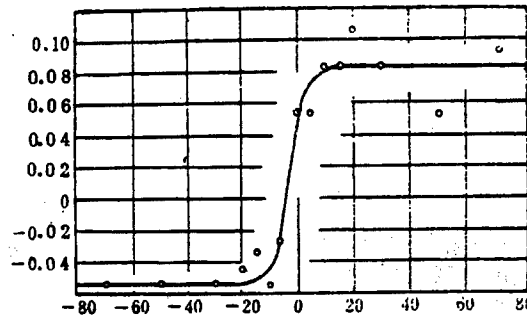

Figure 6. Relationship of Secondary Emissions and Bias

From the figure it can be seen that starting at a bias of about -20 V, the secondary emissions enter the area of the maximum negative value, and within this region, the target secondary electrons are basically suppressed, and the target secondary positive ions are basically collected; starting at positive bias of about +10 V, secondary emissions enter the area of maximum positive value, and within this region, secondary positive ions are basically suppressed, but secondary electrons are basically collected. From this we can tell that the target secondary electrons energy spectrue is largely within 20 eV; the target secondary positive ions energy spectrue is largely within 10 eV. The relative value of the secondary electrons is ≥ 8 percent, the relative value of the secondary electrons is about 5 percent.

To measure the true average strength of the beam burst it is necessary to calculate the grid's capture and loss, and at the same time also effectively suppress the influence of the target secondary positive ions and grid secondary electrons, the measurement circuit is illustrated in Figure 7. At this time, the grid must have a bias voltage of above +20 V added. Using this method we measured the average strength of the above described beam burst (pulse width t_u = 1.13 ns, amplitude I_m = 840µA) as 2.4µA.

Because the target inner tube is 70 mm deep, it takes several microseconds for the secondary electrons emitted by the bottom of the tube to escape and the scattering in the time it takes to reach the tube mouth is considerable, thus, the secondary electrons (or target secondary positive ions) cannot have any significant impact on the pulse waveform on the target. Figure 8 gives photographs of the pulse waveform at the target when the grid is successively positively biased, zero biased, and negatively biased towards the target.
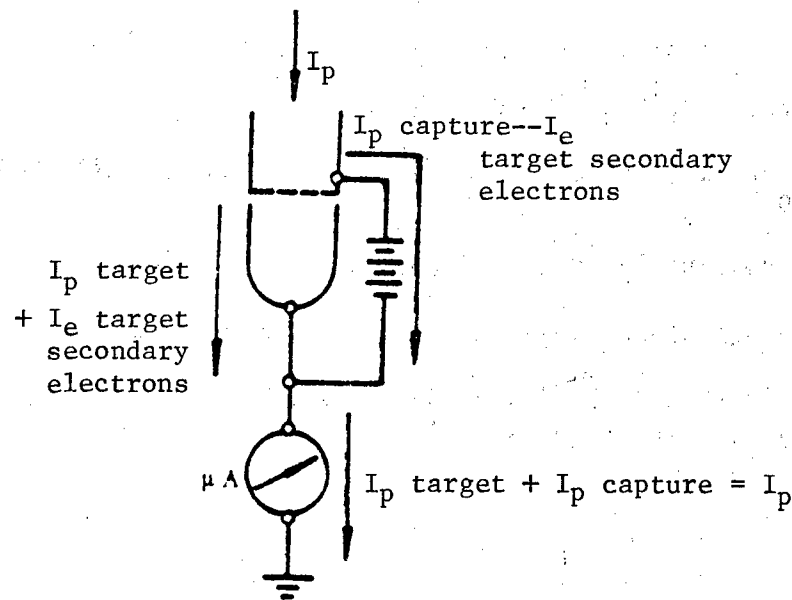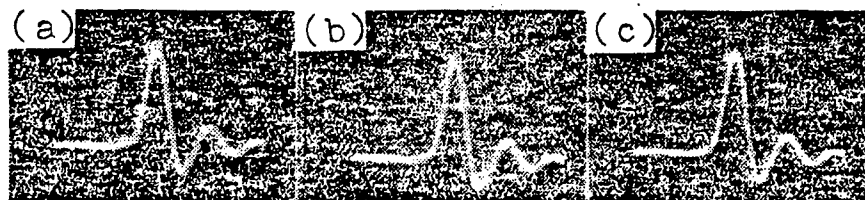
Figure 7. Average Strength Test Circuit

Figure 8. Pulse Waveforms on the Target at 3 Biases

(a) Positive bias +15 V   (b) Zero bias   (c) Negative bias-15 V

From the figure it can be seen that under the three different biases, there is no obvious change in the pulse magnitude.

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APPLIED SCIENCES

MATHEMATICAL PRINCIPLE FOR GENERATING SECOND-ORDER ASPHERICAL SURFACE

[Article by Pan Junhua [3382 0689 7520] and Wang Jianguo [3769 1696 0948],
Nanjing Astronomical Instruments Factor: "Mathematical Principle for
Generating Second Order Aspherical Surfaces"]

[Text] [English Abstract] In this article the mathema-
tical formulas for generating second order aspherical
surfaces are derived. The aspherical surface to be worked
is treated as an envelope of spheres with different radius
of curvature at different zones. δ_p and α_p are taken as
parameters to describe the motion of grinding tool, where
δ_p is the distance between vertex of surface and lowest
point of the tool; and α_p is the angle between tool axis
and aspherical surface axis.

In order to realize the design of practical machine, it is
convenient to change the angle α_p around a point M on tool
axis rather than any other point, so that the equations
for determining the coordinates of point M are also ·
derived.

In the case of mass production, pure mechanism is better
than computer control of the grinding machine, and the best
mechanism seems to be cam pair, because such mechanism
makes the grinding process repeatable and it is possible
to produce a smooth aspherical surface, so that the mathe-
matical equations for cam design are also given.

I. Deriving Basic Relationships

The equation $y^2 = 2R_0 x - (1-e^2)x^2$ is used to express an axially symmetrical
second order aspherical surface, in which R_0 is the radius of curvature at
the highest point, and e is the eccentricity. The distance from the inter-
section O_p of the axis x and the normal line of any point on the curved

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surface P(x,y) from the highest point of the aspherical surface is $R_0 + e^2x$. With O_p as the center of the circle, $\overline{O_pP}$ is the radial working spherical surface, thus point P is the point of contact between the spherical surface and the aspherical surface. For this reason, we can view the aspherical surface as the center of a sphere on a symmetrical axis with a radius which is an envelope of the $\overline{O_pP}$ spherical surface group (see Figure 1).
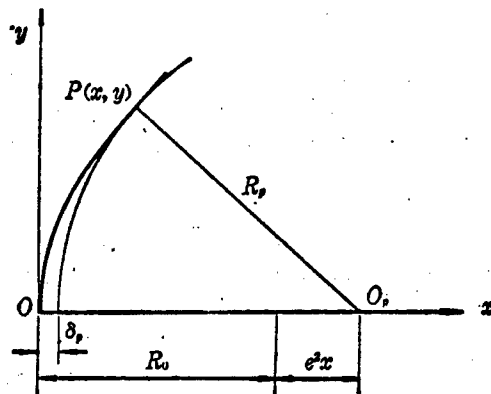

Figure 1.

On the basis of the fancheng [5400 2052] method of grinding spherical surfaces, if the included angle α of the grinding tool axis and the workpiece axis, and the position of the grinding tool axis can be changed, so that in the grinding and grinding process a group of spherical surfaces can be produced which will conform to the above mentioned conditions, then the grinding result will naturally form the required aspherical surface enveloped in this group of spherical surfaces. The problem can now be reduced to finding the position which should be taken by the grinding tool whenever it is raised.

According to Figure 1, it is not hard to write the radius of the spherical section at any point P_y on a curved surface

$$R_y = \overline{O_pP} = \sqrt{[x-(R_0+e^2x)]^2+y^2} = \sqrt{R_0^2+e^2y^2}$$

(1)

To mill this spherical surface using the fancheng method, the tool parameters must satisfy

$$R_p = \frac{d}{2\sin\alpha_p} \pm r$$

(2)

in which α_p is the included angle of the tool axis and the work piece axis, d is the radius inside the grinding ring, r is the small radium of the grinding ring mouth. When the workpiece is a concave surface, Equation 2 takes the "+" sign; when it is convex, it takes the "−" sign. The distance between the highest point A on a spherical surface section and the highest point 0 on an aspherical surface, i.e., the distance δ_p between the lowest point on the grinding ring and the highest point on the aspherical surface, can be used to

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express the shift in the axial direction of the grinding tool. From Figure 1 we know that $\delta_p = R_0 + e^2 x - \sqrt{R_0^2 + e^2 y^2}$. From the aspherical surface equation we can find $x = [R_0 - \sqrt{R_0^2 - (1-e^2)y^2}]/(1 - e^2)$. Thus we get

$$\delta_p = \frac{R_0}{1-e^2} - \frac{e^2}{1-e^2}\sqrt{R_0^2 + (e^2 - 1)y^2} - \sqrt{R_0^2 + e^2 y^2} \tag{3}$$

In all cases, if the basic equation takes the sign "-", then R_0 is considered positive value, thus x is also a positive value. In addition, from Equations 1 and 2 we can find the angle between the grinding tool axis and the workpiece axis.

$$\alpha_p = \sin^{-1}\frac{d}{2(\sqrt{R_0^2 + e^2 y^2} \mp r)} \tag{4}$$

Equation 3 is only established when $e^2 \neq 1$, when $e^2 = 1$, then we can derive

$$\delta_p = R_0 \pm \frac{y^2}{2R_0} - \sqrt{R_0^2 + y^2} \tag{5}$$

for concave surfaces, Equation 4 takes the "-" sign, and Equation 5 takes the "+" sign.

II. Analysis of Movement and Structural Conception of the Grinding Tool

A problem often encountered in practice is the concave surface and in our discussion we have stressed this situation, thus in Equation 4 there is a "-" sign.

Since the grinding tool axis and the workpiece axis are always in a single plane, tool movement can be analyzed as the planar movement of a rigid body, as illustrated in Figure 2. If the center of curvature O_1 of the arc of the selected tool's cutting edge end face is a base point for analysis of tool movement, the movement of the grinding tool can be viewed as a composite of the shift of point O_1 along the x axis and the rotation around point O_1. The law of motion in this situation has already been fully described in Equations 3 and 4, and it is not necessary to derive it again. However, to make the tool rotate around point O_1, is very difficult in structural design, but the selection of a point of rotation in the grinding tool access is easy to realize. Thus, it is necessary to find the expression of this point's movement track.

As illustrated in Figure 2, we study any point M on the grinding tool axis, and set up a movement coordinate system $\xi O_1 \eta$, with the shift of point O_1, we can get

$$\xi = \frac{d}{2}\sin\alpha_p + \overline{QM}\cos\alpha_p, \qquad \eta = \frac{d}{2}\cos\alpha_p - \overline{QM}\sin\alpha_p \tag{3}$$

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Figure 2.

and substituting Equation 4 with the "−" sign in the above equation, we can get

$$\xi = \frac{1}{\sqrt{R_0^2 + e^2 y^2} - r}\left[\frac{d^2}{4} + \overline{QM}\sqrt{(\sqrt{R_0^2 + e^2 y^2} - r)^2 - \frac{d^2}{4}}\,\right]$$

$$\eta = \frac{d}{2(\sqrt{R_0^2 + e^2 y^2} - r)}\left[\sqrt{(\sqrt{R_0^2 + e^2 y^2} - r)^2 - \frac{d^2}{4}} - \overline{QM}\,\right]$$

The coordinate of point M in the xOy coordinate system is $x_M = \xi + \delta_p + r$, $y_M = \eta$ i.e.,

$$(6)\quad
\begin{cases}
x_M = \dfrac{1}{\sqrt{R_0^2 + e^2 y^2} - r}\left[\dfrac{d^2}{4} + \overline{QM}\sqrt{(\sqrt{R_0^2 + e^2 y^2} - r)^2 - \dfrac{d^2}{4}}\,\right] \\[4pt]
\qquad + \dfrac{R_0}{1 - e^2} - \dfrac{e^2}{1 - e^2}\sqrt{R_0^2 - (e^2 - 1)y^2} - \sqrt{R_0^2 + e^2 y^2} + r, \\[8pt]
y_M = \dfrac{d}{2(\sqrt{R_0^2 + e^2 y^2} - r)}\left[\sqrt{(\sqrt{R_0^2 + e^2 y^2} - r)^2 - \dfrac{d^2}{4}} - \overline{QM}\,\right]
\end{cases}$$

In addition, the angle of point M's rotation (counterclockwise) is

$$\theta = \Delta\alpha_p = \sin^{-1}\frac{d}{2(R_0 - r)} - \sin^{-1}\frac{d}{2(\sqrt{R_0^2 + e^2 y^2} - r)} \qquad (7)$$

Since the grinding tool movement determined in Equations 6 and 7 can be controlled by computer, this is suited to manufacture of single components with aspherical surfaces. For large batch production, it is more rational to use a structure for realizing specially defined grinding tool movement. For example, using a plane surface cam. Below we derive the mathematical expression for a cam profile.

Combining the rigidity of the grinding tool axis in the cam, the cam can rotate around point M as the axis (see Figure 3), and perform pure rolling
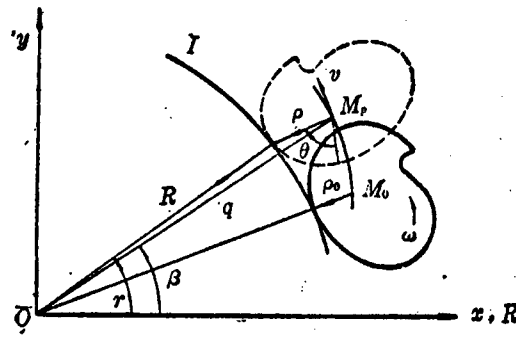
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Figure 3.

motion on template I. The curve of template I has a fixed polar coordinate system, the vertex coinciding with the highest point 0 on the aspherical surface, the initial radial direction coincides with axis x, the counterclockwise motion of the polar angle is correct. The cam curve is a dynamic polar coordinate system, the vertex is the dynamic point M, the initial radial direction is the direction of point M pointing towards point 0 when y = 0, i.e., ρ_0 in Figure 3, the clockwise polar angle is correct.

Analyzing the movement at any time t_p: because the cam rolls purely on the template, at any time contact between the cam and the template is the center of the instant of motion, therefore the speed of movement of point M is

$$v = \rho\omega = \frac{d\theta}{dt} \tag{8}$$

At the same time, point M must move along the track determined by Equation 6, and its speed in the tangent direction of M_p, i.e.,

$$v = \frac{dx_M}{dt} + \frac{dy_M}{dt}, \tag{9}$$

its scalar form is

$$v = \sqrt{\left(\frac{dx_M}{dt}\right)^2 + \left(\frac{dy_M}{dt}\right)^2} \tag{10}$$

From the solution of Equations 8 and 10, we get

$$\rho = \frac{1}{\theta_1}\sqrt{x_M'^2 + y_M'^2} \tag{11}$$

In Equation 6, let

$$\sqrt{R_0^2 + e^2 y^2} = A, \qquad \sqrt{R_0^2 + (e^2 - 1)y^2} = B,$$

$$\sqrt{R_0^2 + e^2 y^2} - r = C, \qquad \sqrt{(\sqrt{R_0^2 + e^2 y^2} - r)^2 - \frac{d^2}{4}} = D \tag{12}$$

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After integrating and carrying out Equations 6 and 7, we can get

$$\begin{cases} \rho = \dfrac{C}{d}\sqrt{4C^2-d^2}\left[\left(\dfrac{\overline{QM}}{D}+\dfrac{A}{B}-\dfrac{d}{4C^2}-\dfrac{D\overline{QM}}{C^2}-1\right)^2+\dfrac{d^2}{4}\left(\dfrac{1}{D}+\dfrac{\overline{QM}}{C^2}-\dfrac{D}{C^2}\right)^2\right]^{\frac{1}{2}} \\ \theta = \sin^{-1}\dfrac{d}{2(R_0-r)}-\sin^{-1}\dfrac{d}{2C}° \end{cases} \tag{13}$$

This is the polar coordinate equation of the cam with y as the parameter.

Let point M as a coordinate in a fixed polar coordinate system b (β, q), then from Figure 3 we can write

$$\rho^2 = R^2+q^2-2Rq\cos(\gamma-\beta),$$

thus

$$R = q\cos(\gamma-\beta)-\sqrt{\rho^2-q^2\sin^2(\gamma-\beta)} \tag{14}$$

The length of arc of the cam and the template rolling are equivalent, i.e., $(ds)^2 = (ds_1)^2$. Thus we can get

$$\left(\frac{d\rho}{dy}\right)^2+\rho^2\left(\frac{d\theta}{dy}\right)^2 = \left(\frac{dR}{dy}\right)^2+R^2\left(\frac{d\gamma}{dy}\right)^2 \tag{15}$$

R is the compound function of q, γ, β and ρ, i.e., R = f(q, γ, β, ρ), thus

$$\frac{dR}{dy} = \frac{\partial R}{\partial q}q'+\frac{\partial R}{\partial \gamma}\gamma'+\frac{\partial R}{\partial \beta}\beta'+\frac{\partial R}{\partial \rho}\rho' \tag{16}$$

From the solution of (15) and (16) we get

$$\begin{cases} \dfrac{d\gamma}{dy} = \dfrac{-\dfrac{\partial R}{\partial \gamma}\left(\dfrac{\partial R}{\partial q}q'+\dfrac{\partial R}{\partial \beta}\beta'+\dfrac{\partial R}{\partial \rho}\rho'\right)\pm\sqrt{\left[\left(\dfrac{\partial R}{\partial \gamma}\right)^2+R^2\right](\rho'^2+\rho^2\theta'^2)-R^2\left(\dfrac{\partial R}{\partial q}q'+\dfrac{\partial R}{\partial \beta}\beta'+\dfrac{\partial R}{\partial \rho}\rho'\right)}}{\left(\dfrac{\partial R}{\partial \gamma}\right)^2+R^2} \\ R = q\cos(\gamma-\beta)-\sqrt{\rho^2-q^2\sin^2(\gamma-\beta)}° \end{cases} \tag{17}$$

The terms in the above equation can be computed one by one through Equations 6, 7, 12 and 13. However, in actuality, Equation 17 is a differential equation which is extremely complex in form and is difficult to find an analytical solution. A computer can be used for numerical integration first to find γ(y), then to find the curve R(y) of the template.

III. Discussion of Some Points

1. On the Suitable Range of This Method

According to Equation 1 we know that when $e^2 > 0$, R_p increases as y increases; when $e^2 < 0$, R_p decreases as y increases. From this it can be seen that this method can process $e^2 > 0$ concave surfaces, but cannot process $e^2 > 0$ convex surfaces; it can process $e^2 < 0$ convex surfaces, but cannot process $e^2 < 0$ concave surfaces.

2. Analysis of Factors Influencing Precision

In principle, point M can be selected at will, but actually, the position of point M has an impact on the precision of processing. From Figure 3 we can get $QM = \frac{d}{2} \text{tg} \varphi$. Substituting in Equation 6 and isolating the term containing $\text{tg}\varphi$, we get $x_M = E + F \frac{d}{2} \text{tg}\varphi$, $y_M = G - H \frac{d}{2} \text{tg}\varphi$. Finding the differential for $\Delta\varphi$ we get $\Delta x_M = F \frac{d}{2} \frac{1}{\cos^2\varphi} \Delta\varphi$, $\Delta y_M = -H \frac{d}{2} \frac{1}{\cos^2\varphi} \Delta\varphi$ in which E, F, G and H are sums which do not contain the term φ. It can be seen that the larger Δx_M and Δy_M. That is, the smaller the diameter of the grinding tool or the farther the point of rotation M from the grinding tool's cutting edge, the greater the processing error.

3. On the Possibility of Processing Higher Order Aspherical Surfaces

The high order aspherical surfaces and second order aspherical surface deflection generally used in optics are not very large, thus envelope spherical surface groups can always be found. According to discussion 1, as long as R_p is within the range of the given value of y, it is a monotone change, thus similarly this method can be used for processing, it is just that the mathematical relationship of δ_p and α_p is more complex.

IV. Conclusion

Through example computations we can see that δ_p and $\Delta\alpha_p$ within the scope of a very large aspherical surface is a small number, and this point is extremely important for insuring processing precision and it is also an important reason why we have devoted our energies to exploring this method.

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SUPERCONDUCTING WIRE MANUFACTURED

[Article by Fu Yuexian [0265 5069 0341], Sun Yue [1327 6390], Xu Shiming
[1776 6108 7686] and Peng Ying [1756 3853], Shanghai Institute of Metallurgy,
Chinese Academy of Sciences: "Practicability of MF Nb/Cu Extruded Composite
Tube Technique for Manufacturing MF Nb3Sn Superconducting Wire*"]

[Text] Preliminary results on study of "MF Nb/Cu Extruded Composite Enriched
Sn Core Diffusion Method Manufacture of MF Nb_3Sn Superconducting Wire" have
already been reported: 1) the wire is easily processed; 2) at field intens-
ity of 4-6T, the effective critical current density of short samples was
high.[1] Schwall et al., of the U.S. IGC[2] used a similar method to manufacture
MF Nb_3Sn superconducting wire (call the "Sn Core Method"); Yoshizaki, et al.,
of the Japanese Mitsubishi Company[3] first manufactured MF Nb/Cu extruded
composite rods, then drilled a hole in the central axis of the rod to get an
MF Nb/Cu composite tube and used it to manufacture MF Nb_3Sn superconducting
wire (call the "Inner Sn Diffusion Method").
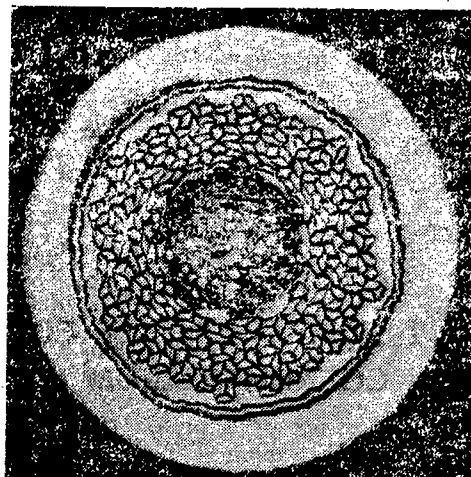
Figure 1. Cross-section of Pure Cu/Ta/11,448Nb Core/91-Sn-Cu Wire

*Paper received on 7 July 1984

We used the "MF Nb/Cu Extrusion Tube Method" to manufacture 3 kg of stable practical MF Nb_3Sn composite superconducting wire containing pure Cu(RRR $\sim$ 200)/Ta. The draw state composite wire diameter was $\phi 0.56$ mm, it contained 11,448 x 2.6 μmNb core, and the twist distance was 1.5 cm. The composite wire cross-section (from outside to inside) was pure Cu/Ta/11,448 Nb core/ Cu/ 91Sn-Cu (Figure 1); containing 22.8 v. percent pure Cu, 13.3 v. percent Ta; within the Ta layer to prevent Sn diffusion, the area ratio

$\dfrac{A_{Cu} + A_{Sn-Cu}}{A_{Nb}} \approx 1.8$; containing 36.2 w. percent Nb; the average content of

Sn in the matrix was 20.3 w. percent. The wire was sheathed in nonalkaline glass fiber as an insulating layer. We cut off a section of wire weighing 160 g and coiled it into a small solenoid (due to restrictions of the existing backfield magnetic aperture) with inner diameter $2a_1 = 15$, outer diameter $2a_2 = 28$, height $2b = 80$ mm. After reaction diffusion processing at 675°C/30 (feizhongken [7236 0322 5146] system) and curing by vacuum dipping in paraffin, it was measured in a Nb-Ti backfield of 7.2 T intensity, a current of 129 A was passed through the Nb_3Sn solenoid and produced a strength of 2.5 T, the overall magnetic field intensity of the composite magnet reached 9.7 T. At this time, the wire full current density (not including insulation layer) $J_{c.w.} = 5.2 \times 10^4$ A/cm^2; the effective current density $J_c(Nb + Cu + Sn - Cu) = 8.2 \times 10^4$ A/cm^2.

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CSO; 4008/1046

APPLIED SCIENCES

ULTRAHIGH VACUUM EQUIPMENT DESCRIBED

[Article by Li Yuzhi [2621 3768 5347], Jing Shiqun [2529 4258 5028], Department of Physics. University of Science and Technology of China, Hefei, and Peng Xianhui [1756 0341 2585], Institute of Plasma Physics, Chinese Academy of Sciences, Hefei: "The Ultrahigh Vacuum Equipment for Filming With a Blockade Valve and a Substrate at Liquid Nitrogen Temperature*"]

[Text] This article reports on ultrahigh vacuum equipment for filming with a blockade valve and a substrate at the temperature of liquid nitrogen. It has the following characteristics:

First, the vacuum chamber is exposed to the atmosphere, the blockade valve can maintain a vacuum of $1-10^{-9}$ torr for a long period of time.

Second, it greatly reduces the working cycle compared to before the blockade valve was installed.

Third, the temperature of the sample substrate in the vacuum chamber can be adjusted continuously between 77 K and room temperature.

Since the ultrahigh vacuum filming equipment China now produces does not have an ultrahigh vacuum valve, when inserting and removing samples, the pump casing is exposed to the atmosphere so that even after the pump has been operating for a time, its limited vacuum is generally of the magnitude of 10^{-8} torr.

To achieve a better vacuum, each time the samples are changed, it is necessary to go through the baking and the entire vacuum creating processes once again and this is very troublesome. Not only does it lengthen the work cycle, but frequently exposing the atmosphere to the vacuum pump is not good either.

So as to get the best vacuum we could and at the same time reduce the work cycle, we installed a bakeable metallic blockade valve in between the vacuum

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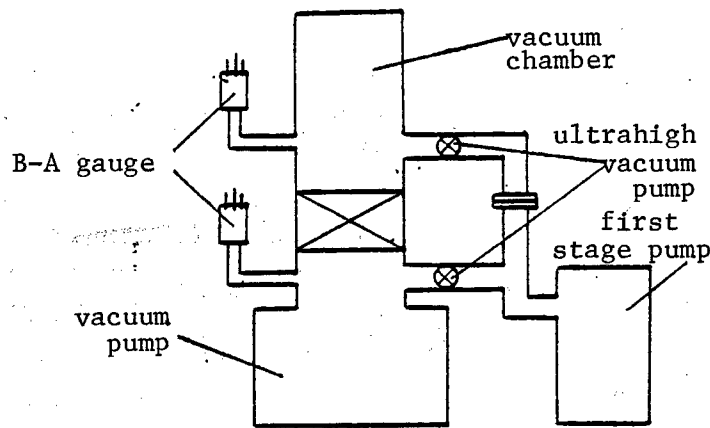
* Paper received on 10 September 1984.

Figure 1. Diagram of System

pump intake and the vacuum chamber to form a filming device. The overall structure is illustrated in Figure 1.

1. Blockade Valve

The blockade valve is made up of two parts: the valve and the valve seat see Figure 2). The valve can be moved left and right in the valve seat by mechanical means.
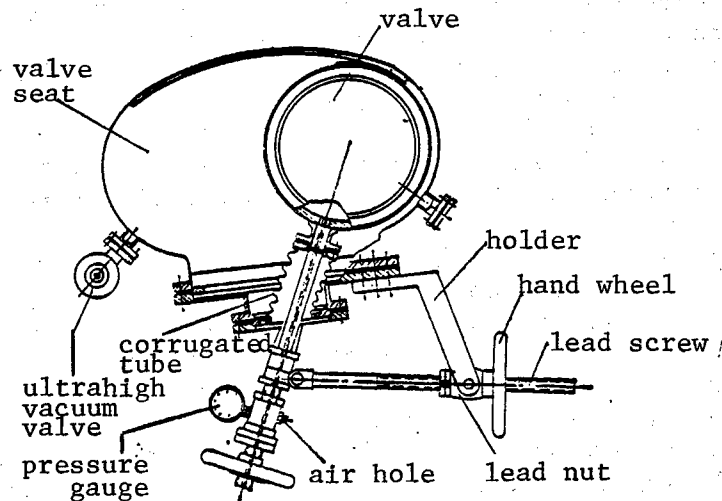

Figure 2. Diagram of Blockade Valve

When the valve is in the rightmost position (illustrated in Figure 2), the vacuum pump is connected to the vacuum chamber. When the valve is in the leftmost position, the blockade valve seals off the vacuum pump, i.e., the vacuum chamber can be opened and samples changed.

The sealing principles of the blockade valve are illustrated in Figure 3.

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metal seal ring ─── ·spring
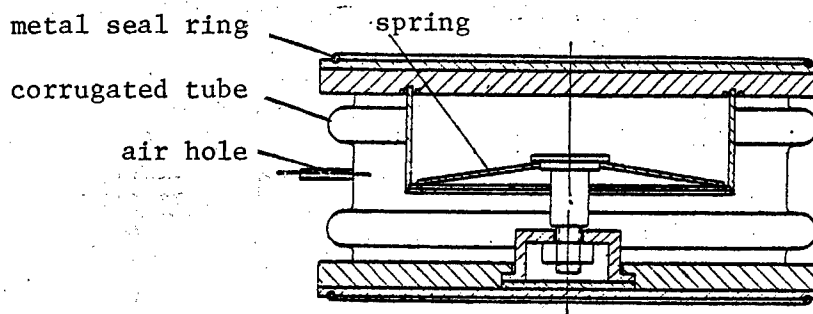
corrugated tube ───

air hole ───

Figure 3. Diagram of Blockade Valve Sealing Principles

The valve is a cylindrical cavity on the sealing side. The sidewalls are made of telescoping corrugated tubing. The top and bottom are metal sheet, and there is a metal seal ring on the top and bottom of them. There is a strong spring inside the cavity, and an air hole in the side wall.

When the valve is filled with nitrogen at a pressure of 20 kg/cm^2, due to the telescoping nature of the corrugated tube, the air pressure overcomes the elastic force of the spring and forces the metal seal rings to press tightly against the upper and lower flanges and makes it airtight. At this time the blockade valve puts the vacuum pump in the sealed state. After the air is released from the blockade valve, the action of the spring makes the upper and lower walls more inward and the seal rings separate from the flanges leaving a gap (about 0.5 mm) and at this time the valve can be shifted to the rightmost position. To insure that the blockade valve will not suffer any mechanical damage, the valve can shift slightly to left and right in the valve seat. Thus, air can be drawn from the valve through the air hole so that when the valve is in a state when it is basically not subject to pressure it moves left and right and thus also insures the elasticity of the spring.

After installing the blockade valve, the key to whether or not the goal of achieving a reduction in the work cycle is in the sealing performance of the blockade valve. Repeated tests showed that when the atmosphere had been exposed from the vacuum chamber for half a day, the vacuum pump could still maintain a vacuum of 1×10^{-9} torr. Thus, after sealing the vacuum chamber, for vacuum chamber's baking and sampling vacuum, the blockade valve can be opened and a high vacuum or even an ultrahigh vacuum created. Test results showed that utilizing the blockade valve to maintain a vacuum pump vacuum of 1×10^{-9} torr, after the valve was opened, the vacuum chamber could quickly reach $6-8 \times 10^{-10}$ torr. With the blockade valve not only is the work cycle reduced, but that the labor intensity of many minor problems, such as removing and installing magnets, and the baking system was greatly reduced.

Since the vacuum environment is key to the length of baking time and the temperature, the blockade valve must withstand baking at high temperatures (200°C). Thus, a bakeable metal was used for the blockade valve, and this is an important difference between this device and other devices.

2. Vacuum Chamber

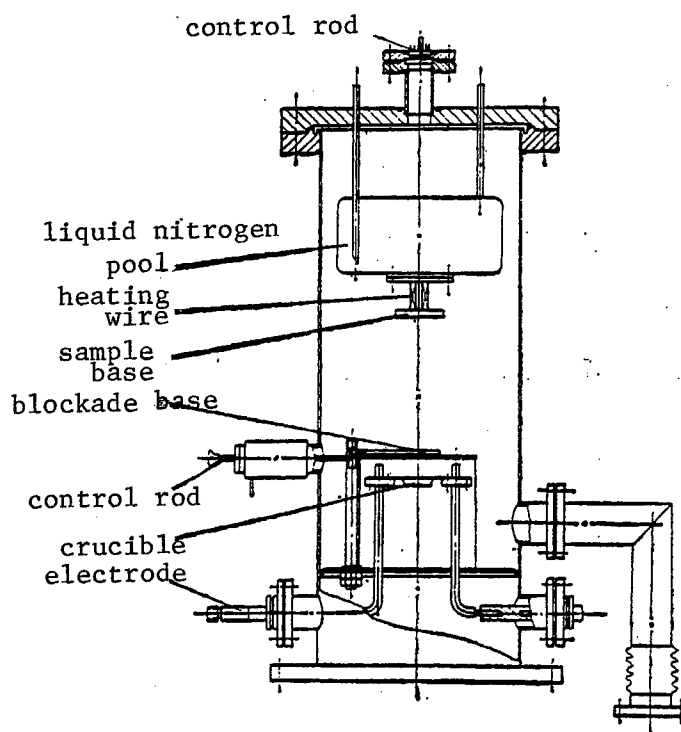The structure of the vacuum chamber is illustrated in Figure 4.

Figure 4. Diagram of Vacuum Chamber

Within the vacuum chamber there is a liquid nitrogen pool. The thermal conducted sample is fixed under the liquid nitrogen pool and a good thermo-contact is made between the two. To be able to manufacture samples meeting different demands, a thermal wire is wrapped around the sample base. Thus the temperature of the sample substrate can be adjusted between the tempera-ture of liquid nitrogen (or even lower) and room temperature (or even higher).

So as to be able to operate the valve freely, we placed the control rod pro-jecting out of the vacuum chamber under a low vacuum cover. Otherwise, the atmospheric pressure would have exerted a strong action so that the rod could not be pulled out, ultimately leading to loss of control over the valve (see Figure 5).

3. Conclusion

Compared with existing ultrahigh vacuum filming equipment in China, this device is simple and economical, the vacuum has been increased several levels, and it can make samples at different substrate temperatures.

strut

corrugated
tube

low vacuum
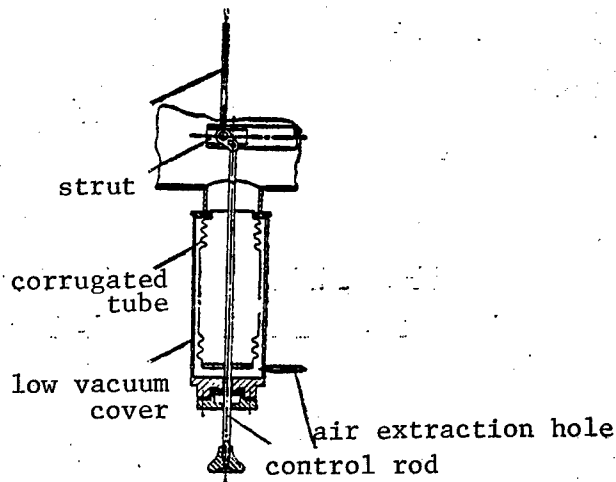cover

air extraction hole

control rod

Figure 5. Diagram of Blockade Valve Operation Mechanism

Because this blockade valve and vacuum chamber are still only in the initial design stage, there are certainly many places that can be improved; these will be discovered in future use.

The entire process of building this device was carried out with the direct concern and guidance of Professor Zhang Yuheng [1728 5940 1854] and Comrade Cao Xiaowen [2580 2400 2429] of the Plasmatron Institute participated in the design of the vacuum chamber, and here we thank them.

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APPLIED SCIENCES

CHEMOMETRICS IN CHINA RECOUNTED

[Article by Chen Nianyi [7115 1819 6318]: "Chemical Pattern Recognition and Its Applications--Research Notes"]

[Text] In the past 7 years, I have been working on "Chemical Pattern Recognition" (or chemometrics), published 18 years in journals such as SCIENTIA and ACTA METALLURGICA SINICA, and made presentations in two international academic meetings. In addition to basic research, our research accomplishments have already been applied to areas such as oil exploration, environment evaluation, cancer causation and diagnosis, chemical data bank, catalyst screening, amorphous alloy development, prediction and synthesis of intermetallic compounds, and quality control of beer. Chemical pattern recognition was one of , the important contents in my lectures in the United States. We have also established contacts with many chemometrics workers in Europe and America through the International Chemometrics Society. "Chemical Pattern Recognition" (or chemometrics) is an active new field in the world. It not only involves fundamental research but also has a wide range of applications. In comparison, there are very few people working in this area in China. Recently, we compiled a microcomputer "chemometrics software" (also known as "microcomputer software for multifactor determination method") in coordination with the climax in microelectronics and microcomputer applications. It will be published and promoted.

In this paper, I intend to casually talk about the understandings, thoughts and plans in the research of chemical pattern recognition. We hope to attract more comrades to join our "loose league."

Starting Point: Computerization of "Chemical Bond Parameter Method"

In the 10-year period from 1964 to 1975, I was involved in the study of "chemical bond parameter method." I was merely trying to find some empirical patterns from some planar diagrams prepared by simultaneously using two chemical bond parameters (or their functions). Because two parameters contain more information than one, more empirical patterns could be found to solve practical problems. Hence, I said in a national meeting in 1977 that "what I did in the past 10 years is to add another coordinate in the chemical bond parameter method used by Pauling, et al., to replace one dimension by two

dimensions." (Rigorously speaking, Pearson had used two dimensional parameters to summarize crystallization patterns. However, he did not use it as widely as I had.)

After the dual parameter chemical bond method was published, it was used by many people because it is a relatively easy method. Some of my friends suggested that I should organize a large team centered around the chemical bond parameter method. I do not agree with this kind of suggestion because I feel that the dual parameter chemical bond method has several obvious defects. Even if we ignore the lack of rigorous theoretical background, although one parameter (one dimension) is obviously not sufficient in practical applications, two parameters may not be universally suitable. Many problems in chemistry and materials science are very complex with many influencing factors (including microscopic and macroscopic factors). The results of two-dimensional planar diagrams may be good sometimes, however, a multidimensional space will have to be used as a generalized method.

Since 1975, many scientists (the earliest one is Guan Weiyan [4619 1919 3508] of the Institute of Physics) suggested that I should "computerize" the chemical bond parameter method. However, that was not realized until after 1976 with the assistance of Xie Leiming [6200 7191 7686]. Initially, computers were used instead of men to plot bond parameter diagrams. It soon entered the transition stage of "linear discriminating function method" in pattern recognition. In 1977, Jiang Naixiong [3608 0035 3574] and Li Qingzhi [2621 1987 5347] of Shanghai Institute of Computing Technology collaborated with us to develop the "nonlinear projection method." This is a convenient method to project a multidimensional pattern on a two-dimensional plane without much distortion. By 1979, we had already grasped a complete set of chemical pattern recognition programs to computerize the research on "chemical bond parameter method."

Because of computers, our work has already caught up with the modern trend of using artificial intelligence and pattern recognition to solve chemical problems.

Marching Towards Research on New Materials

I had been involved in materials science research for many years and am fully aware of the difficulties in "finding new recipes" for new materials. Many tempting techniques such as "material design" and "molecular design" are promoted by some scientists in the world. I believe that there are two approaches to material design and molecular design. One, the "deductive method," is to determine the relation between material structure and its characteristics theoretically in order to point out specific directions for the development of new materials by deduction. The other is to use "inductive" methods to provide new clues for the development of new materials by processing information stored in "data bases" or "knowledge bases"* based on

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*Data bases and knowledge bases are new products for storage, retrieval and processing information with computers. They not only can store data but also figures and natural languages such as Chinese, English and Japanese to satisfy the needs of the users.

a large amount of experimental data with pattern recognition software. I thought that the first method would be more attractive. But, it takes too long to realize. The second method can be feasibly realized at the present moment. In 1980 I visited the University of Tokyo in Japan and saw the "alloy design system" led by Professor Mishima and the "mathematical planning system" by Professor Yoneda and their affiliated data bases. Japanese scientists have already started on a large scale and have obtained certain results. I decided to primarily devote to the second direction. Due to limited resources, I only could begin with pattern recognition.

(I) We used pattern recognition to summarize the crystalling patterns for intermetallic compounds[1,2,15] and found a series of empirical laws. On this basis, we can make computer forecasts about unknown intermetallics and their crystal forms. Because intermetallic compounds frequently have unique physicochemical characteristics (such as magnetism, superconductivity, hydrogen storage, etc., it is a major area for the exploration of new performance materials. Based on our projection, there are still thousands of intermetallic compounds yet to be discovered. There are more than 100 unknown intermetallic compounds containing rare earth, tungsten and antimony which are abundant in China. This is enough reason to stir up some interests to develop new materials (because of the discovery of a high performance intermetallic compound, the Japanese recently announced that they had already invented third generation permament magnets). The Institute of Precious Metals of the Ministry of Metallurgical Industry collaborated with us to synthesize new rare earth intermetallic compounds according to computer forecast. As we presented our forecast on $CaCu_5$ in SCIENTIA SINICA in July 1981, the first projected compound, $LaPd_5$, had already been successfully synthesized in Kunming.[3] Furthermore, based on x-ray diffraction, the projected crystal form was confirmed. We have been collaborating with Kunming Institute of Precious Metals for over 4 years. Xu Hua [1776 2901] and Ning Yuantao [1380 6678 3447] have determined five new intermetallic compounds including $LaPd_5$, $EuNi_2$ and $EuFe_2$.[4,5] Next we will forecast the physical properties of intermetallic compounds. If successful, it will be more significant to the exploration of new materials.

(II) We used pattern recognition to summarize the law of formation of amorphous alloys. Shi Tiansheng [2457 1131 3932], et al., first used bond parameter pattern recognition to summarize the formation patterns of binary amorphous alloys.[5] Feng Pingyi [7458 1627 5030], et al., extended this forecasting method to multi-element amorphous alloys and estimated that the rare earth--semimetal--transition metal ternary system would be a hopeful area to explore for amorphous alloys. Under the guidance of this idea, we developed a rare earth-containing iron-based amorphous alloy which is resistant to 4N hydrochloric acid. It was proved experimentally that the stability and corrosion resistance of amorphous Fe-Cr-Ni-P-B alloy series could be improved by adding rare earth metals. It also indicates that it is indeed feasible to find new materials with the assistance of pattern recognition.

(III) Comrade Li Deyu [2621 1795 1342], et al., collaborated with us to use bond parameter pattern recognition to study laser modulating materials and

found the Curie point pattern for perovskite ferromagnets.[7] This also proved the usefulness of multidimensional information processing in the research of new materials.

In our work in the aforementioned areas, we realized that the "nonlinear projection method" is a very useful pattern recognition technique. The essence of this method is to transform a diagram in a high dimensional space to a two-dimensional one, i.e., a planar diagram. Of course, it is impossible to transform a high dimensional diagram into a planar one without any distortion. However, it is possible to minimize the variation of the distance between points (average value) in the transformation. Based on this condition, a two-dimensional diagram with least distortion can be obtained. Using Figure 1 as an example, points (•) represent samples capable of forming amorphous alloys and points (x) represent samples not capable of forming amorphous alloys. In this two-dimensional figure one can obviously see that they are located in different regions. Because people can directly perceive a two-dimensional diagram, this method is very convenient. Of course, because of the dimensional change and a certain degree of distortion, the coordinates in the two-dimensional diagram are "muddled coordinates." However, this fact does not hinder its applications. Other figures in this paper are also nonlinear projection diagrams.
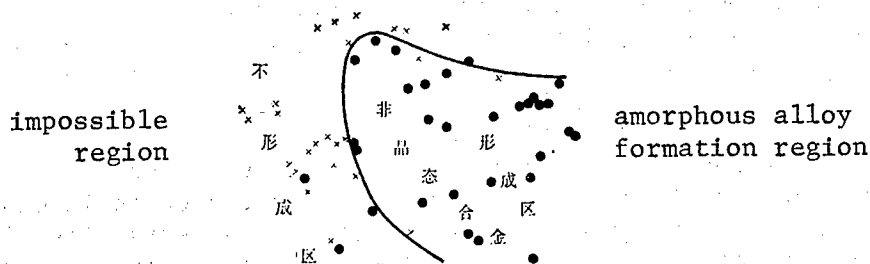

Figure 1. Condition for Formation of Amorphous Alloy

The Institute of Chemical Engineering and Metallurgy of the Chinese Academy of Sciences established an "inorganic thermochemical data bank" which is capable of retrieving the thermochemical characteristics of 1840 inorganic compounds. This is very useful to various research and design departments working on chemical engineering and metallurgy, especially in the comprehensive utilization of natural resources. However, it was also discovered that data needed by many production departments is not in the data bank. Could pattern recognition forecasting be used? Xu Zhihong [6079 1807 1347], who was in charge of this work, became our collaborator. From early 1983, we combined the pattern recognition method with the inorganic thermochemical data base and attempted to perform computer forecasting on the free energy, entropy, and enthalpy of a compound whose thermodynamic properties were not measured. Presently, some results are obtained in the computer forecasting of the free energy, entropy, and heat capacity of complex oxides. We plan to expand the applicable range of this type of forecasting method. On the other hand, we plan to "plant" the pattern recognition pattern into the data base based on research results.

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Assisting in Oil Exploration

In October 1978, the first national geochemistry meeting was held in Quiyang. During the meeting, I talked about chemical bond theory and pattern recognition method. Cheng Zhichun [4453 1807 4783] of the Oil Exploration Brigade of the Ministry of Geology [and Mineral Resources] talked to me about using pattern recognition for oil prospecting. He told me that there is a Sulin [5685 2651] school of thought in the Soviet Union. They summarized the practical experience in Russia and presented a series of empirical laws to correlate the ground water composition to the oil reserve. In the early fifties, Russian experts brought this experience to China. However, such experience did not work in China. One of their laws is that "if the stratigraphic temperature is lower than 50°C and the ground water is the sulfate type, there is no oil reserve there." But, the Jianghan Oil Field in China does not obey this law. Cheng Zhichun proposed to use chemical pattern recognition to summarize the patterns in China in order to facilitate oil exploration. Hence, we collaborated in using chemometrics (a total of eight routine indicators) and the stratigraphic oil reserve in nine oil fields in China.[8,9] Obvious patterns were indeed discovered (see Figure 2). In December 1981, geological departments held an oil field water chemistry meeting in Heifei to introduce this research accomplishment. A recent chemometric study of the information on a certain oil field indicated that the pattern recognition technique could be used to extract underground oil reserves based on the results of chemical analysis of drinking water from wells. Chemical oil prospecting techniques based on data analysis by chemometrics are successfully employed in the survey of oil fields in China.

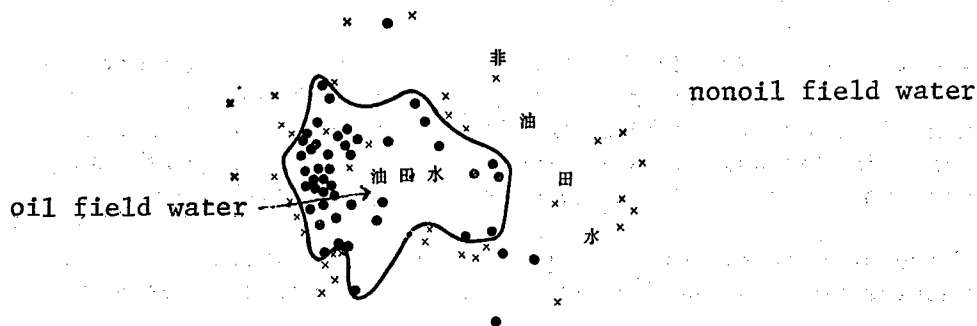We believe that chemometrics will be useful in the chemical prospecting of other minerals.

Figure 2. Relation Between Water Composition and Oil Reserve in Huabei Oil Field

Fighting Cancer

Shu Yongchang [5289 3057 2490] of Huazhong (Central China) University of Science and Technology and I collaborated in 1981 to study the cancer causation pattern of aromatic hydrocarbons using chemometrics.[10,11] This work was reported in the 1982 international chemical carcinogenic mechanism discussion meetings. In the meeting, someone suggested that I should use

pattern recognition for the early diagnosis of cancer. If a cancer patient is diagnosed early, the curing probability can be improved. Therefore, early diagnosis is an important subject. I was very interested in this subject. However, I could not find a party to collaborate with until 1983. There are some breakthroughs in two aspects.

In the summer of 1983, I was invited to lecture in Xi'an by the Chemical Society of Shaanxi. Guo Cheng [6753 6134] of Jiangxi Institute of Metallurgy and Zhu Huifu [2612 1741 4395] of Gannan Medical Institute came to see me after the talk. They were trying to use cross immuno-electrophoresis of blood to diagnose cancer and wished to use chemometrics as the technique. Early this year, we worked together to process cross immuno-electrophoretograms chemometrically. We have clearly separated 31 liver cancer patients from 31 healthy people without any exception (see Figure 3).
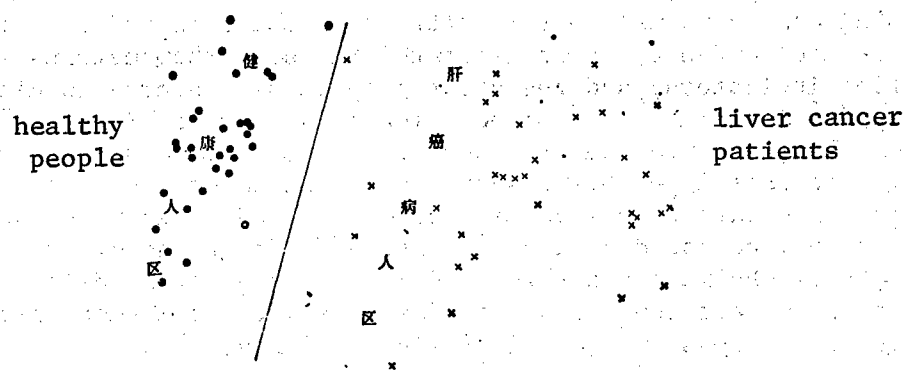

Figure 3. Difference in Plasma Cross Immuno-Electrophoretograms of Liver Cancer Patients and Healthy People

In the summer of 1983, Xu Huibi [1776 6540 4310] of Huazhong (Central China) University of Science and Technology used our chemometric program to process the data of eight minute elements in the hairs of lung cancer victims in the Gejiu area in Yunnan. It was also possible to distinguish lung cancer patients (including early stage victims) from healthy people.

There have been papers in the literature in the world reporting the use of chemometrics to diagnose leukemia. It also appears to be a hopeful direction.

One of the major problems in the early diagnosis of cancer is mistakes and oversights. We believe that the multidimensional information processing of several cancer diagnostic datum by pattern recognition can reduce the rate of error and oversight. Of course, we must still work hard in a coordinated manner to establish a generalized cancer screening method.

Xu Huibi of Huazhong (Central China) University of Science and Technology collaborated with us to process the data on the intake of selenium, arsenic and cadmium in 25 countries and 2 regions in the world and the breast cancer death rate, and discovered a distinctive correlation between the two. This result not only is useful for environmental evaluation but also brings about

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a profound question that whether changing the intake of minute elements can lower the cancer mortality rate for the population.[12]

Provide Consultation for Chemical Production

Bai Naibin [4101 6621 1755], a long time researcher working on petrochemical catalysts, came to my laboratory as a graduate student for 3 years. He used pattern recognition to screen catalysts used in petrochemical engineering. He collaborated with Shanghai Institute of Synthetic Resins to use chemometrics to summarize the pattern for high efficiency catalysts used in the production of low density polyethylene (see Figure 4). They used catalyst activated temperature; percentage of chromium, titanium and fluorine contents; regulated ratio of 1-butene and ethene needed for polymerization; polymerization temperature; pressure and fluidized velocity etc., as parameters to select the optimum region for activity, product density and melting index; obtaining useful results in production.[13,14]
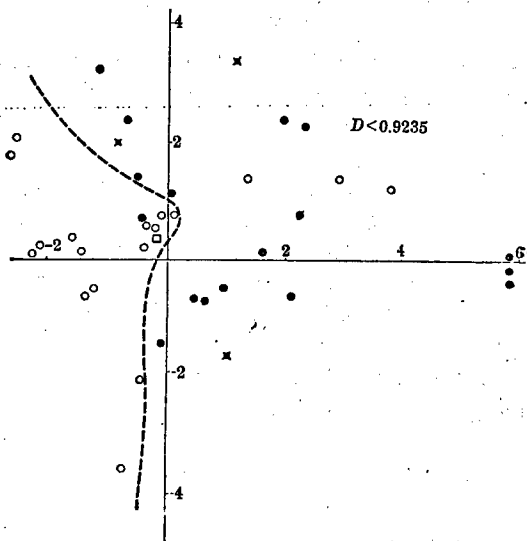

Figure 4. Factors Affecting the Density of Polyethylene

Because the taste of food is a multifactor problem, it is usually evaluated by tasting, which often does not agree with indicators in physical and chemical tests. Thus, food production cannot be scientific. In recent years, progress has been made in studying the taste of food by chemometrics in the world. An international meeting was held. Recently, we collaborated with a beer brewery to process the multidimensional information between the tasting results of beer with six physicochemical test indicators such as alcohol content, actual concentration, color, acidity, diacetyl content and bitterness. An apparent correlation between physicochemical indicators and tasting results was discovered. It provides a new possibility for improving the quality of beer produced.
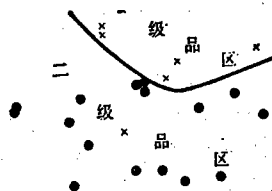
Second quality
region

一级品区

二级品区

Figure 5. Classification of Beer Quality According to Physical and Chemical Indicators

Using Chemometrics To Study Life Sciences

In addition to a variety of applications, chemometrics is also very useful in fundamental science research.

The place where information is most concentrated in the universe is in nucleic acids and proteins in cells. Can chemometrics be used to help us reveal such life science information? I think it can be done.

Recently, Jiang Shouping [3068 1108 1627] of the Institute of Biochemistry and I collaborated in an attempt to forecast the secondary structures of proteins based on primary structures (amino acid sequence) using chemometrics. The primary structure of protein is easy to determine, while the secondary structure is far more difficult. Preliminary results indicated that the accuracy of predicting the secondary structure based on the primary structure could reach 80 percent. The work has just begun in this area and there is plenty of room for improvement.

Popularizing Microcomputer Programs for Pattern Recognition

As the new technological revolution progresses, the climax of the microcomputer will soon arrive. Our pattern recognition program was run on a Chinese-made model 709 computer. If it can be modified for a microcomputer, then it will be easy to popularize. With the assistance of Jiang Naixiong [3608 0035 7160], Mou Qiang [4924 1730] compiled a microcomputer program for pattern recognition, which is called "chemometrics software" or "multi-factor recognition method program for microcomputers." The results were quite good. We are planning to start training courses.

According to the trend of chemometric research in the world, pattern recognition is useful in product inspection, environmental evaluation, analytical method evaluation, spectrum recognition, clinical chemistry, food industries, archaeology, forensic investigation, etc. As analytical chemistry develops, more and more data and diagrams are obtained by precision instruments. How can we effectively extract the information? Pattern recognition can be very powerful. I think that in the future promotion of pattern recognition we will need guidance and assistance from analytical chemists in order to have a brighter prospect.

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APPLIED SCIENCES

AUTOMATIC ROUTING SYSTEM FOR PRINTED CIRCUIT BOARDS DESCRIBED

[Article by Yang Daoyuan [2799 6670 3104], Beijing Institute of Chemical
Technology, and Gao Jianyu [7559 0494 1342], Institute of Computing Technology,
Chinese Academy of Sciences: "An Automatic Routing System for Nonstandard
Double-Sided Printed Circuit Boards"]

[Text] 1. Brief Introduction to the Routing System

This system is based on a NOVA computer with 32 Kbyte of internal storage and
a word length of 16 bits. It is primarily used for automatic routing on non-
standard printed circuit [PC] boards. The characteristics of the nonstandard
double-sided printed circuit boards are: on the same board they have solder pads
of various diameters, circuits of various widths, and many thin traces branching
from the thick traces. Use of mini- or microcomputers for automatic routing on
such boards is very significant.

For user convenience there are three data input formats: grid coordinate
format, component number format, and cursor keyboard entry format.

Once the data are entered, line allocation is performed, and routing is then
begun. The nonstandard boards processed by this system include two different
trace widths. The wider traces are 1.2~2.0 mm across, and the narrower traces
0.3~0.5 mm across. There are also two solder pad diameters, 2.5 and 1.4 mm.

The layout results can be displayed on a 4014 unit or drawn by a plotter. The
system has a variety of auxiliary programs that can be used to refine the
results. Finally, after optimization, the system can output a paper tape for
photoplotting a negative, or the red litho master itself can be cut directly.
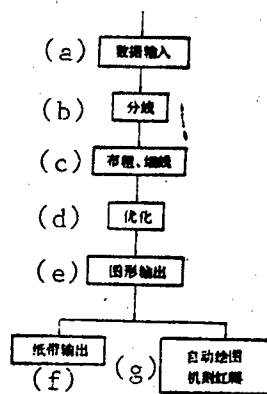
A block diagram of the system is shown in Figure 1.

(a) 数据输入

(b) 分线

(c) 布板、编线

(d) 优化

(e) 图形输出

(f) 纸带输出   (g) 自动绘图机割红膜

Figure 1. Block Diagram of Routing System

Key:

    a.   Data input
    b.   Trace allocation
    c.   Routing of thick and thin
    d.   Optimization
    e.   Graphic output
    f.   Paper tape output
    g.   Automatic plotting and machine cutting of red master

2. Structure of the Routing System

Since the methods used in the system are similar to those described in Refs. 2 and 3, here we will limit ourselves to describing two characteristics of the system.

A. Use of Bits To Represent Points on the PC Board

In the computerized automatic wiring layout process, the characteristics of every point on the board must be entered into the computer in order for layout work to proceed properly. Usually the board is divided manually into numerous small grids, each [made] of which is actually one point on the PC board. In order to save internal memory space, each bit in each memory location of the computer represents one point on the PC board. This saves memory space and produces a one-to-one correspondence between a memory area in the computer and the printed circuit board, which simplifies lookup and the solution of difficult routing problems. It should be emphasized that, depending on the complexity of the problem, 1, 2 or 3 bits can be used to represent a single point on the board; this feature should be flexibly utilized in accordance with the specific problem.

Definition: When the bits in an area of internal storage are used to represent a point on a PC board so that there is a one-to-one correspondence between this area of memory and the board, the memory area is called a "bit map" of the board. Within the bit map, each logical connection bit represents a channel on the PC board. Therefore, computerized routing can be performed in the bit map.

B. Use of a Flow Data Structure

The system has two bit maps: one for the heavy grid, representing the thick traces, and the other for the light grid, representing the thin traces. Each bit map is in turn divided into two sections, representing the two faces of a two-layered PC board. Two wiring result tables, one for thick traces and one for thin traces, record starting points, "borrowed" hole end points and various other information. The two interconnection tables record the starting points and end points for the thick and thin connections which the user wishes to make. The two single-hole tables record the positions of the holes of the two different diameters.

Routing involves a large amount of data and many tables, and all characteristics must be entered into memory one at a time, so that a large memory area is required. In order to save internal memory space, all of the tables described above are placed on magnetic disk. Only a single bit map is present in internal storage; the wide trace bit map when routing the wide traces, and the narrow trace bit map when routing the narrow traces. The memory also contains a partial interconnection table with a capacity of 128 interconnections, and a partial results table of only 512 locations.

In the wiring layout process, the interconnection table stored on magnetic disk is divided into 128-trace sections, and one section is transferred to the partial interconnection table area in internal storage. When layout for this section is completed, it is replaced by another section. If the partial results table becomes full, it is transferred to the results table area on magnetic disk and the recording of new routing results is begun.

Single holes are brought together during processing of the data and are stored in the hole table on magnetic disk. They are not again returned to internal storage.

3. Problems and Methods of Solution

A. Because traces of two different thicknesses are used, the problem of what wiring sequence to use arises. The method used in the system is as follows.

Let S be the set of all large and small solder pads and single holes used in the mixed routing process, let D_i be the width of the i-th type of trace, with $D_i < D_{i+1}$, and let L_i be the set of routing results for the i-th trace width (i = 1, 2, 3,...). Then, in the mixed routing process, only when all traces of width D_{i+1}, D_{i+2} have been laid out can the routing of lines with diameter D_i be begun; when routing lines of diameter D_i, the routing barrier is

$$M_i = S \cup L_{i+1} \cup L_{i+2} \cup \cdots.$$

The basic conception of this method is that the wide traces are routed before the narrow traces, and that the previously laid out wide traces are barriers to the subsequently laid out narrow traces.

If during mixed routing we used the method normally used with a single wiring grid, then the wide and narrow traces would use different channels. If a narrow trace occupies one channel, then a wide trace must occupy two or more channels. Thus a new problem arises: the difficulty of writing a program that will lay down one wide trace in two or more parallel empty channels. Since our system uses mixed wiring with traces of two different widths, we use the variable grid method, i.e., the area on the board represented by the grid for the wide traces is 4 times that of the grid for the narrow traces, and thus a channel used in laying out a wide trace is equivalent to two of the channels used in laying out narrow traces.

Thus both wide and narrow traces are laid out in single channels, and accordingly we can use the same program for the two different types of channels, which solves the routing problem in a simple manner.

C. Method of Data Entry

Figure 2 [on following page] shows the bit map for the narrow-trace grid and the partial inter-connection table and partial results table that are permanently resident in memory, along with a diagram of an actual board.

When layout is begun, all starting points, end points and single holes are entered separately into the interconnection tables and hole tables, and 1's are placed in all of the corresponding locations in the two bit maps (e.g. points A, D, H, K, F, G on the board shown), which are then stored on magnetic disk.

The wide traces are laid out before the narrow traces; the locations of the wide traces are recorded in the wide trace result table, and 1's are entered in the wide trace grid bit map. When beginning to route the narrow traces, 1's are entered in the points on the narrow trace grid that are occupied by wide traces (such as HD in the diagram; wide trace HD is equivalent to two parallel grids in the narrow trace grid.

The partial results table shown in the figure records the narrow traces. The "4" in the table indicates that the four records following it represent the same line; obviously, the first and fourth records are the starting point and end point of this line, while the second and third are the coordinate position of the "borrowed holes" for this trace. These four records completely determine the position of this trace.

Once this trace is laid out, we enter 1's in the positions in the vertical trace section of the narrow trace grid bit map; we similarly enter 1's in the locations representing the positions of horizontal trace sections in the bit map for the horizontal traces; these are barriers to the traces laid down subsequently. When wide and narrow traces connect (as at point D in the figure)
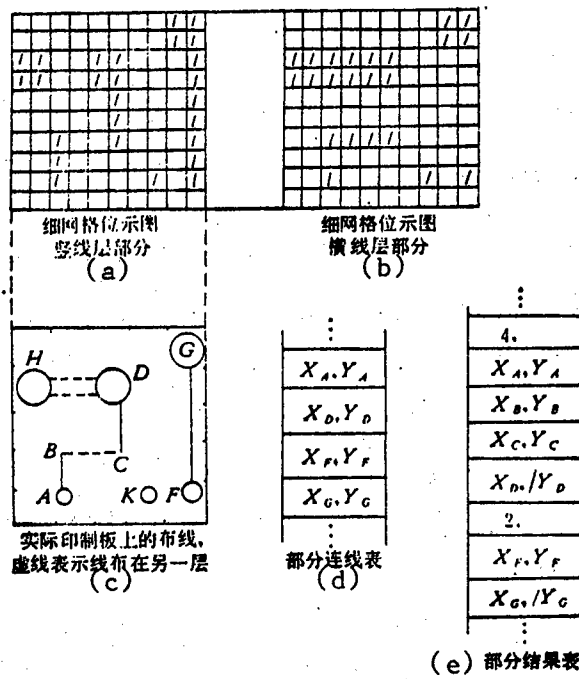
細网格位示图
竖线层部分
(a)

細网格位示图
横线层部分
(b)

实际印制板上的布线,
虚线表示线布在另一层
(c)

部分连线表
(d)

(e) 部分结果表

Figure 2.   Bit Maps, Tables, and Board

Key:

    a.   Section of thin-wire grid for layer containing vertical intercon-
        nections
    b.   Section of thin-wire grid map for horizontal traces
    c.   Interconnections on actual board; dotted lines indicate that inter-
        connection is on other layer
    d.   Part of interconnection table
    e.   Part of results table

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or when narrow traces are connected to large solder pads (as at point G), a special try must be made. In this case a 1 is placed in the highest-order bit of record Y of the coordinate records in the results table.

When this system was applied, it succeeded in completing more than 98 percent of the interconnections; the routing results were excellent. When a bit representation of points on the PC board and a flow data structure were used when laying out a 175 x 156 mm board, the space occupied by all of the system's tables and maps was constant and about 6,000 locations sufficed to hold them regardless of the number of holes and lines. When the number of connections was increased to 300-400, the average layout time was 2 to 3 minutes.

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8480
CSO: 4008/301

APPLIED SCIENCES

UNIX-BASED PROCESSING TECHNIQUE FOR CHINESE CHARACTERS DESCRIBED

[Article by Lei Tianmo [7191 1131 2875], Li Xiaoming [2621 1420 2494] and Lu Zhixing [4151 2535 2502], Computing Center, Guangdong Province: "A UNIX Chinese Character Processing Technique"]

[Text] Chinese-character input and output [I/O] is a major aspect of Chinese-character processing. It involves Chinese-character coding schemes, Chinese-character internal code selection, Chinese-character I/O equipment, and I/O implementation methods (i.e. Chinese-character I/O technology). In implementation, these aspects are both interrelated and independent. Here we describe a Chinese-character I/O technique implemented in the UNIX operating system. It has already been used on a 16-bit MC68000-based microcomputer and has received a technical evaluation [1]. The system can be used on all computers equipped with the UNIX operating system.

Existing character systems in China mostly modify the operating system's I/O module in order to implement Chinese-character I/O. A major problem of this approach is that it is difficult to do and may easily affect compatibility with the original system. The technique described here involves adding a Chinese character outer-shell or "Chinese character command interpretation routine" in the outer layers of the operating system to provide Chinese-character I/O. Because it is in the outer layers of the operating system, no major changes are made in the kernel, so that compatibility with UNIX is maintained and the technique is extremely simple to implement (see figure).

Paper received 20 Dec 83.
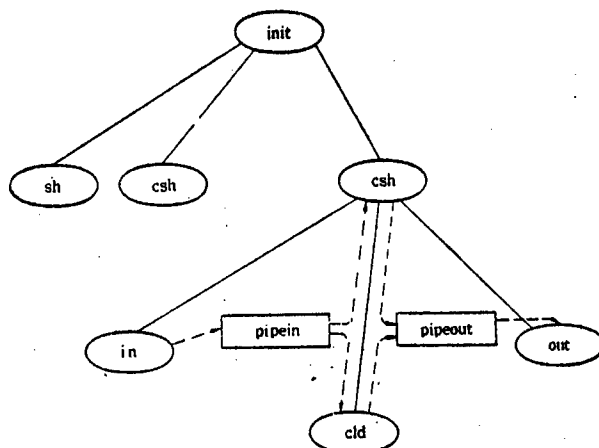
UNIX is a very successful time-sharing system. UNIX Version 7 can support 50 programs. In addition it provides various means of communication between processes such as PIPE, SIGNAL, etc. The multiple processes supported by UNIX are process families with downward branching trees. The ancestor process is at the top vertex and several descendent processes below it; each descendent process gives rise to more descendent processes [2]. In these process families, each subroutine has its own function, and various communication methods carry out the Chinese-character processing task in coordinated fashion.

The basic concept of this technique is as follows. The initialization process INIT sets up the ancestor process for Chinese-character shell CSH; CSH has the same status in the system as other shells, such as SH, CSH [as published] and the like, established by INIT (Figure 1). CSH also generates an input process IN and an output process OUT and establishes the input pipe PIPEIN and the output pipe PIPEOUT between CSH, IN and OUT. The task of IN is to read from the keyboard and to convert the external Chinese character code that it obtains from the keyboard into an internal Chinese-character code. The IN process places the Chinese-character machine code and other keyboard inputs in PIPEIN. CSH takes the output of IN from PIPEIN, from which it also receives keyboard commands from the operator. CSH checks and interprets the keyboard commands and executes them by generating a new process CLD, which also receives keyboard inputs from PIPEIN. The outputs of CSH and CLD are placed in PIPEOUT. The output subroutine OUT processes the data in PIPEOUT. For example, it converts the Chinese-character internal code into a Chinese-character dot matrix which it forwards to a display or printer driver routine. When CLD has finished it notifies CSH, which resumes reading keyboard commands from PIPEIN and generating new CLD's to execute them, proceeding in a continuous cycle. The IN process is keyboard interrupt-driven. When PIPEOUT is empty, OUT hangs up, but any input to PIPEOUT reactivates it. Thus the addition of CSH, IN, and OUT produces the same result as modifying the operating system's I/O program. In contrast to such a modification of the I/O module, this technique also includes unlocking of the input and output PIPE processes. Because the pipes are in internal storage, these overheads are small. Because the added CSH, like the original SH, is in the outer layers of the UNIX system, it causes no change in the UNIX core and preserves compatibility with UNIX.

This technique is added on to the UNIX multiprogramming and process communication tools and does not involve the I/O equipment or driver programs; thus it is a universally-applicable Chinese-character processing technique within UNIX. The Chinese-character shell CSH, as well as IN and OUT, are written in C language, which increases their portability.

CSH, IN and OUT are three independent entities. When running, they are stored as three separate processes in the system program key. In the design process they were written as three separate programs. Because of this characteristic, this I/O technique is even more loosely connected to other aspects of Chinese-character I/O such as the Chinese-character coding scheme, Chinese-character internal code selection, and Chinese character I/O equipment. The technique

is easily adapted to various coding schemes or various internal codes and all I/O devices and can easily be made to process any other types of characters. Our system is a multilanguage system and currently can process various alphabets.

Implementing this technique in UNIX requires solution of other problems, such as sharing of the Chinese-character dictionary and vocabulary by several Chinese-character users' IN and OUT processes. Multiple programs supported by UNIX cannot share data areas. Changing this characteristic would affect compatibility. Our method is to change the UNIX paragraph and page virtual address management program. We separated out from the UNIX virtual address space a dictionary and vocabulary which were not controlled by the virtual address mapping structure and functioned solely for storage and readout of Chinese characters; thus multiple users' multiple processes can share this space. The UNIX virtual address store management technique in a minicomputer with Multibus structure can manage 16-Mbyte address space (if the backup bus lines are not used) and separate off several hundred Kbyte without affecting system capabilities and characteristics, which also makes it unnecessary to alter hardware in order to establish a Chinese-character vocabulary and dictionary.

Because the PIPE file and the like are unique features of UNIX, and other time-sharing systems that support multiprogramming lack this characteristic. Hence, this processing technique for Chinese characters described here is difficult to be used in other time-sharing systems.

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APPLIED SCIENCES

BRIEFS

ION CYCLOTRON BEING INSTALLED--Lanzhou, 10 Sep (XINHUA)--China's first heavy
ions cyclotron system is being installed at the Lanzhou Institute of Modern
Physics, under the Chinese Academy of Sciences. The installation work has
proceeded smoothly since it began in August, and will be finished in 1988,
said Wei Baowen, director and chief engineer of the institute in this capital
of Gansu Province today. Only a few countries, including France and Japan,
have such systems, which are used in nuclear physics research as well as in
other fields of work such as developing new industrial materials and tech-
nology. The one being installed in Lanzhou is "comparable" in sophistication
to those in other countries, Wei said. The system consists of a sector-focus-
ing cyclotron and a separated-sector cyclotron. Reinforced concrete shields
and other facilities have been built to prevent any possible leakage of
radioactive rays when the system goes into operation. [Text] [Beijing XINHUA
in English 1523 GMT 10 Sep 85 OW]

FACILITY FOR RADIATION EXPERIMENTS--Beijing, 15 June (XINHUA)--China has
produced its first experimental facility for positron annihilation radiation,
according to the Chinese Academy of Sciences here today. The facility is a
basic experimental means for metal research, the examination of the dynamic
distribution of electrons in materials and other physical and chemical
research. The facility was made by the Chinese Science and Technology
University, the institutes of high energy and metal research and the Shenyang
Scientific Meters Factory.

CSO: 4010/170

Applied Mathematics

AUTHOR: WANG Huiming [3769 1920 2494]

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TITLE: "The Strong Law of Large Numbers for Martingale Differences and the Strong Consistency of the Least Squares Estimators of Regression Coefficients"

ABSTRACT: This paper studies the convergence rate of the least squares estimators $\hat{\alpha}_{jN}$ to the regression coefficient α_j in the linear model $Z(n) = \sum_{j=1}^{l} \alpha_j \varphi_j(n) + X(n)$, $n = 1, 2, \cdots, N$. First we discuss the conditions for the upper limit of $\sum_{j=1}^{n} \frac{\sigma_j X_{(j)}}{b_n}$ to be zero or finite (a.s.), when $\{X_{(n)}\}$ is a sequence of martingale differences and $\{\sigma_j\}$, $\{b_n\}$ are nonrandom sequences. Then we discuss the convergence rate of $\hat{\alpha}_{jN}$. Particularly for $\{X_{(n)}\}$ i.i.d. with $N(0,1)$, we obtain the best convergence rate. (Received 11 January 1983, revised 25 June 1984).

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CSO: 4009/1123

Applied Mathematics

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ORG: East China Institute of Chemical Technology

TITLE: "The Solutions for the Two-Point Boundary-Value Problems of
               Stochastic Differential Equations Containing Small White Noises"

ABSTRACT: This paper is concerned with a stochastic two-point boundary-value problem containing small white noise

$$\begin{cases} dx(t) = f(t, x(t))dt + \varepsilon\varphi(t)dW(t,\omega), \\ Ax(0) + Bx(1) = \alpha(\omega) \end{cases}$$

where ε is a parameter and W a Wiener process.

When ε is small, the problem has a unique solution that can be expanded in ε, and its density can be obtained by means of some numerical procedures.

The discussion is given in the scalar case, but extensions to higher dimensions are readily available.   (Received 29 August 1983; revised 28 July 1984)

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AUTHOR: ZHANG Weitao [1728 4850 1718]

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TITLE: "Boundary Layer Estimation of a Linear System of the Elasticity"

ABSTRACT:

In this paper, we consider the linear system of the elasticity:

$$\begin{cases} \varepsilon \Delta^2 u_{i\varepsilon} + \sum_{j=1}^{m} b_{ij}(x) u_{j\varepsilon} = f_i(x), \\ u_{i\varepsilon}|_\Gamma = \dfrac{\partial u_{i\varepsilon}}{\partial N}\Big|_\Gamma = 0, \quad i = 1, \cdots, m. \end{cases} \tag{1}$$

let

$$\begin{cases} s_1 \sum_{i=1}^{m} y_i^2 \leqslant \sum_{i,j=1}^{m} b_{ij} y_i y_j \leqslant s_2 \sum_{i=1}^{m} y_i^2, \quad s_2 \geqslant s_1 > 0, \\ b_{ij}(x) = b_{ji}(x) \in C^2(\bar{\Omega}). \end{cases} \tag{2}$$

let $d(x, \Gamma)$ be the distance from $x \in \Omega$ to Γ.

$$\bar{J}_4(\lambda) = \int_{d(x,\Gamma) \geqslant \varepsilon^\lambda \log(1+\varepsilon^{-\beta})} \sum_{i=1}^{m} |\Delta(u_{i\varepsilon} - u_i)|^2 dx, \quad \alpha(\varepsilon) = \frac{1}{4} \log_\varepsilon \frac{s_1}{C} \ (C > 1),$$

$F = (f_1, \cdots, f_m), H_1 = (H_0^1(\Omega))^m \cap (H^2(\Omega))^m, H_2 = (H^2(\Omega))^m, k_1 = \dfrac{1}{4}, k_2 = \dfrac{1}{12}.$

When $F \in H_i$, we have the follwing boundary layer estimates for problem (1):

i) In the regular region when $\lambda_0 \leqslant \lambda \leqslant \dfrac{1}{4} - \alpha(\varepsilon)$, we have

$$\bar{J}_4(\lambda) \leqslant C \sum_{i=1}^{m} \|f_i\|^2_{H^2(\Omega)}.$$

ii) In the region of increasing singularity, when

$$\frac{1}{4} - \alpha(\varepsilon) < \lambda < \frac{1}{4} + \frac{k_i}{4}, \quad \text{we have}$$

$$\bar{J}_4(\lambda) \leqslant C \varepsilon^{-\frac{1}{4}\lambda + 2k_i} \sum_{i=1}^{m} \|f_i\|^2_{H^2(\Omega)}.$$

iii) In the region of stable singularity, when

$$\lambda \geqslant \frac{1}{4} + \frac{k_i}{4}, \text{ we have}$$

$$\bar{J}_i(\lambda) \leqslant C\varepsilon^{-1+k_i} \sum_{j=1}^{m} \|f_j\|^2_{H^1(\Omega)},$$

where $\beta \geqslant \frac{11}{12}$, c denotes a constant independent of ε, and $i = 1,2$.

(Received 1 September 1983; revised 17 July 1984)

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[6]   [Chinese reference]

AUTHOR: WU Xixin [0702 1598 0207]

ORG: Hunan University

TITLE: "Energy-Saving Methods in Fractionation Operation"

SOURCE: Shanghai HUAXUE SHIJIE [CHEMICAL WORLD] in Chinese Vol 26, No 5, 20 May 85 pp 184-185

ABSTRACT: In petroleum refining and some chemical industries, fractionation operation consumes the largest share of energy by far. The investigation into energy saving practices is very important to industry. The reflux ratio is the most important factor affecting fractionation energy consumption since it increases linearly with rising reflux ratio. Owing to the increase in stages in the fractionating tower with higher costs, an optimal reflux ratio can be found with the minimum overall cost of equipment and operation. Once an optimal reflux ratio is determined, its value should not be randomly changed. Otherwise, end product quality will be affected. Preheating of feedstock also is helpful in energy saving. Proper feedstock intake levels when entering the tower can smooth out operations, thus raising efficiency. Finally, lowering the operational pressure can lead to impressive energy savings owing to a reduced reflux ratio. For example, in an annual output of 300,000 tons of ethylene operation, 5.7 tons of high pressure steam (per hour) can be saved. Four figures show a linear relationship between heat supply and product outflow, relationships between reflux ratio and expenses, as well as between product purity and energy consumption, and heat balance of the fractionation tower. One table lists recommended values of reflux ratios.

10424
CSO: 4009/1117

AUTHOR: HUANG Guifang [7806 2710 5364]
          YU Ximao [0151 1598 5399]
          DING Mingyu [0002 2494 3768]

ORG: HUANG and DING of Department of Chemical Analysis, Wuhan College
of Geology; YU of Department of Chemistry, Wuhan University

TITLE: "A New Highly Sensitive Reagent, p-Acetylcarboxylazo-p, for
Determining Thorium"

ABSTRACT: A developer, p-acetylcarboxylazo-p, has been synthesized for the
first time by the Wuhan University; the agent is used in the luminescence
analysis of rare earth elements. The optimal conditions of the development
reaction between the developer and thorium are presented. In the 0.1 N
hydrochloric acid, a blue complex is formed and will remain stable for
12 hours. In a 25 ml volume, the range of 1 to 18 Ug of ThO_2 obeys Beer's
Law. At present, this is a highly sensitive method for determining trace
amounts of thorium. Satisfactory results can be obtained in analyzing ore
specimens by using the method. Two figures show the absorption (spectrum)
curves and working curve. Two tables list data for the recovery experiment
and sample analysis results. References include (1) Pan Jiaomai [3382 2403
7796], Chen Yasen [7115 0068 2773] and Yan Hengtai [0917 1854 1132],
XIANSEJI JIQI ZAI YEJIN ZHONGDI YINGYONG [DEVELOPER AND ITS APPLICATIONS IN
METALLURGICAL ANALYSIS], Shanghai Science and Technology Publishing House,
416 (1981), and (2) Hubei Geology Laboratory, GONGWU YANSHI FENXI [ANALYSIS
OF MINERALS], 284 (1972).

10424
CSO: 4009/1113

Computers

AUTHOR: YANG Wei [2799 3837]

ORG: Technical Department, Baoshan Iron and Steel General Works

TITLE: "Application of Microcomputer to Spectrophotometric Analysis I.A.
Program for Simultaneous Determination of Multicomponents in
Solution"

ABSTRACT: An, ERCON' computer program in BASIC is designed for simultaneous
determination of the colored multicomponent in solution. An automatic weight-
ing and ordering is so introduced for all measured values based on the devia-
tion of spectrophotometric determination as to be capable of the calculation.
A verification is given from the mixtures of $CuCl_2$, $NiCl_2$ and $CrCl_3$ in a solu-
tion. (Paper received on 2 April 1984)

CSO: 4009/1121

AUTHOR: XU Chi [1776 7459]

ORG: Shanghai Metallurgy Institute, Chinese Academy of Sciences

TITLE: "Chemical Applications of Pattern Recognition Approach"

ABSTRACT: Pattern recognition is a new method for computer based optimiza-
tion in multiple, complicated messages in meaning discrimination and decision-
making. The simple principle of "Birds of a feather flock together" is
applied in substances classified by their features. For example, product
quality in a technical process depends on 10 related parameters, such as
temperature, pressure, grain size, and amount of catalyst. Under what
conditions can product quality be enhanced with a high percentage of high-
grade product? The answer is nearly impossible to obtain from 1,000
observation data. However, a 10-dimensional model can be constructed
mathematically (in a computer) to represent each observation as a point
in 10-dimensional space. It has been discovered that each group of first
grade, second grade and third grade products occupies a distinct region
in the mathematical space. By this approach, product quality can be enhanced
by providing favorable manufacturing conditions. Under the guidance of
professor Chen Nianyi [7115 1819 6318], the author developed a method and
program of patter recognition. Described in the article are applications
in petroleum prospecting based on chemical features, in catalyst design,
in metallurgy, in geochemistry, and in food inspection. Progress was
recorded in synthetic rubber, early cancer detection, and relationship
between trace elements and cancer with the pattern recognition approach.
Three figures show regions (in mathematical space) of high nickel recovery,
classification of ore types, and beer quality patterns. Four tables list
selected parameters in water samples of oil- and nonoil-bearing strata
in two oil fields.

AUTHOR: XIONG Jianguo [3574 1696 0948]
        ZHAO Wenfang [6392 2429 2455]

ORG: Institute of Engineering Mechanics, State Seismological Bureau

TITLE: "Evaluation of Overturning-resistance of High-rise Buildings with Basement Shelters"

TEXT OF ENGLISH ABSTRACT: The purpose of this paper is to investigate the overturning-resistance of highrise buildings with basement shelters under airblast loading. In the paper, to simulate the separation of the foundation from the soil and the elasto-plastic behavior of the soil, the foundation is assumed to be absolutely rigid and its surrounding soil is represented by distributed ideal elasto-plastic springs without tensile resistance. Furthermore, 2 analytical models for the structure-foundation-soil system are adopted and 120 groups of soil characteristics values and 5 groups of air-blast loading characteristics are used in the parametric studies for a 14-story building. The overturning-moment-rotation relation is derived. Effects of factors such as the soil characteristics, foundation stiffness, relative contribution of the soils under the base of the foundation and around the side wall, the explosive yield and the building dimensions on the overturning-resistance are examined.

12949
CSO: 4009/286

AUTHOR: ZHUANG Wenjun [8369 2429 0689]
          WANG Shoujiao [3769 1344 6030]

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "A Method Based on Overall Consideration for Routing on the Single Plane"

SOURCE: Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese
Vol 13 No 2, Mar 85 pp 1-10

TEXT OF ENGLISH ABSTRACT: A new method based on overall consideration for routing on the single plane is presented. This method is also called track loss-profit analysis. In order to minimize the total track loss, the relationships among individual nets are analyzed first. Then the routing way and order of each net are determined based on the overall consideration of the set of relative nets. This method can improve the rate of completion by about 10 percent in complex routing problems ($R \geq 0.48$) when compared with other methods which determine the routing order of each net. (Paper was received in January 1984, and was finalized in September 1984.)

AUTHOR: RUAN Chenli [7086 2052 4409]

ORG: Chengdu Institute of Radio Engineering

TITLE: "Parametric Down Converters"

TEXT OF ENGLISH ABSTRACT: A new type of four-frequency parametric converter
has been designed according to the different roles of frequency components in
the process of frequency transformation. A small signal analysis is conducted
giving the conditions for conversion gain, stable operation and resonance.
The resonant conditions define the requirements for circuits and nonlinear
elements in the realization of the new down converter. (Paper was received
in December 1983, and finalized in May 1984.)

AUTHOR: ZHANG Xingling [1728 5281 0109]
          GUO Minyan [6753 2404 3601]

ORG: Institute of Modern Physics, Chinese Academy of Sciences

TITLE: "A Method for Calculating the Basic Parameters of Three-Dimensional Cavity Resonators"

TEXT OF ENGLISH ABSTRACT: As is well known, it is very advantageous to calculate the basic parameters of two-dimensional cavity resonators, made of ideal conductors, by solving the equations $\nabla^2 E + K^2 E = 0$ and $\nabla \cdot E = 0$. Such a method has been developed for three-dimensional cases. Instead of the usual linear extrapolation, a new method with high accuracy is proposed for treating the boundary condition for the normal component of the electrical field. The numerical results are fairly satisfying. (Paper was received in November 1983, and finalized in August 1984.)

AUTHOR: PENG Yi [1756 3015]
          ZHANG Youzheng [1728 2589 2973]

ORG: Chengdu Institute of Radio Engineering

TITLE: "A Unified Version of Transform Methods and the Duality Theory of Sequences"

TEXT OF ENGLISH ABSTRACT: The theory for the duality of sequences and the multiplicity of transform-pairs is presented, and the essential relationships of the Fourier-Transform (FT) pair, Fourier-Series-Transform (FST) pair, Fourier Z-Transform (FZT) pair and Discrete Fourier-Series-Transform (DFS) pair as well as a unified expression of these four transform pairs are given. Some new ideas and methods for the application of the duality theory are presented, such as cross convolution, cross cyclical convolution and borrow transform-pair methods. (Paper was received in September 1983, and finalized in May 1984.)

AUTHOR: SHI Yongji [0670 3057 1015]

ORG: Luoyang Institute of Constructional Materials Industry, Luoyang

TITLE: "Micro Statistical Model of 1/f Noise in Semiconductor Devices"

TEXT OF ENGLISH ABSTRACT: In semiconductor devices the number fluctuation and mobility fluctuation models of 1/f noise have many limitations. A micro statistical model of 1/f noise by the Boltzmann transform theory is proposed. A general formula of 1/f noise spectrum density is deduced. This formula agrees with experimental results. (Paper was received in July 1983 and finalized in July 1984.)

AUTHOR: ZHU Shengchuan [2612 3932 0278]

ORG: Department of Physics, Beijing University

TITLE: "The Phase Shift and Loss of Microstrip Ferrite Phaser"

TEXT OF ENGLISH ABSTRACT: The phase shift and loss problems of a microstrip
ferrite phaser are investigated. The relative permeability of the ferrite
substrate and the reduced magnetization of the substrate magnetic circuit
are analyzed. The calculation formula for the phase shift is given, and the
factors which affect the phase shift are discussed. The expression of the
conductor attenuation constant for coupled strips on a magnetic substrate
is derived, and the formula for phaser insertion loss calculation is given.
The theory developed is used to analyze the phase shift characteristics and
insertion loss of a phaser, and good agreement with the experimental results
is obtained. Both the theoretical analysis and experimental results show
that the so-called "two shortcomings of the meander line phaser--the lower
phase shift efficiency and the higher internal resonance loss" can be overcome
and a high quality phaser (a 4-bit device, insertion loss = 1dB, bandwidth =
20 percent) can be realized. (Paper was received in November 1983, and
finalized in June 1984.)

AUTHOR: DONG Shaoping [5516 4801 1627]
          ZHAO Shuqing [6392 3219 3237]

ORG: Harbin Institute of Technology

TEXT OF ENGLISH ABSTRACT: A new method is described for designing FUR digital
filters.   A desired frequency response can be regarded as the sum of elementary
frequency units (EFU) triangle-shaped with different central frequencies.
Adding together the time sequences corresponding to these EFU, the filter's
impulse response can be obtained.   The advantage of the method is that the
time duration of the impulse response is about one-third less than that
obtained by the window method with the slight sacrifice of the pass-band
ripple (within 2 percent).   The method can be used for designing filters
with an arbitrary frequency response (such as low-pass, high-pass, band-pass
or band-elimination filter), Hirbert transformers or differentiators.
(Paper was received in September 1983, and finalized in July 1984.)

AUTHOR: SHEN Shihu [3947 4258 5706]
            YUAN Shiwen [5913 4258 2429]

ORG: Northeast Heavy Machinery Institute

TITLE: "Synthesis Theorems for the Topology of (M+N)-Port Network"

TEXT OF ENGLISH ABSTRACT: The synthesis theorems presented are new results
of the applications of graph-theory for network synthesis and belong to the
basic theory for topological synthesis of (M+N)-port networks. The topology of
a passive unbalanced (M+N)-port network consisting of a single class of
elements may be easily realized by means of these theorems when the transfer
matrix is given. (Paper was received in October 1983 and finalized in
April 1984.)

AUTHOR: ZHU Binglin [2612 3521 2651]

ORG: Microwave Division, Southwest Research Institute of Electronic
Technology

TITLE: "Frequency Response Characteristics of a Class of n-Way Planar Hybrid
Power Dividers"

TEXT OF ENGLISH ABSTRACT: A method for calculating the frequency response
characteristics of the planar hybrid power divider (PHPD) is presented. The
frequency response characteristics of three-way, four-way and five-way PHPDs
on the voltage standing wave ratio, power transmission coefficient and isola-
tion are given. As for the three-way PHPD, the loss of uniform transmission
lines and its influence on the performance of PHPD are discussed. (Paper was
received in November 1983 and finalized in April 1984.)

AUTHOR: ZHANG Xikang [4545 3556 1660]
          WANG Ying [3769 4964]
          BAI Guoren [4101 0948 0088]
          et al.

ORG: Shanghai Institute of Metallurgy, Chinese Academy of Sciences

TITLE: "Influence of Oxygen on the Photo-induced Effect in a-Si:H"

TEXT OF ENGLISH ABSTRACT: The photo-induced conductance change decreases with
the increase in oxygen content in the a-Si:H films. The IR absorption spectra
show that in oxygen-doped a-Si:H films, oxygen atoms serve as bridging atoms
in the Si-Si weak bonds. The analysis of absorption data indicates that a
small amount of oxygen can reduce the disorder of a-Si:H networks. In addition,
illumination promotes the coupling of bridging oxygen atoms, suggesting that
the Si-Si weak bonds are broken by photons during illumination. From the
experimental results it is concluded that oxygen atoms stabilize the weak
bonds and thus reduce the photo-induced conductance change. (Paper was
received in October 1983, and finalized in September 1984.)

9717
CSO: 4009/1097

AUTHOR: HUANG Ruji [7806 3067 3423]

ORG: Department of Automatic Control, Beijing Iron-Steel College

TITLE: "Principal Partition and Optimal Harmonious Decomposition of Electrical Networks"

TEXT OF ENGLISH ABSTRACT: An improved algorithm for finding the principal partition of a linear graph is presented. The concept of harmonious decomposition tree of a graph is introduced, followed by a description of methods for finding all harmonious decompositions and the optimal harmonious decomposition of a network graph. These methods will favor the application of diakoptics. (Paper was received in December 1983 and finalized in July 1984.)

AUTHOR: SUN Qiwan [1327 0796 8001]

ORG: Southwest China Research Institute of Electronic Technology

TITLE: "Stability Criteria for General and Delay Sampled Phase-locked
Loops"

TEXT OF ENGLISH ABSTRACT: General stability criteria commonly used in the
design of sampled phase-locked loops and delay sampled phase-locked loops
are derived by using the stability theory for sampled data control systems
as well as the z-transform method and its modification.   The important
relationships of these criteria are also given.   (Paper was received in
December 1983 and finalized in March 1984.)

AUTHOR: HAN Jieping [7281 7132 1627]
          ZHONG Huili [6988 1979 5461]
          MA Junru [7456 0193 1172]
          et al.

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "A Study of Light-induced Properties of 5-Nitroacenaphthene"

TEXT OF ENGLISH ABSTRACT: Remarkable changes of physical and chemical
properties are found in exposed 5-nitroacenaphthene, which is usually used in
negative photo-resists as a sensitizer. Analytical results demonstrate that
5-nitroacenaphthene has undergone photo-reaction during the exposure. Its
main photo-product is 8-methyl-4-nitro-1-naphthealdehyde ($C_{12}H_9NO_3$, or MNNA).
Using these changes of photo-induced properties of 5-nitroacenaphthene,
selective etching on SiO_2 is realized and the mechanism of lithography
without development is given a satisfactory explanation. (Paper was
received in March 1983 and finalized in June 1983.)

AUTHOR: CAO Kangbai [2580 1660 4101]
          DOU Wenbin [4535 2429 2430]
          XUE Liangjin [5641 5328 6855]

ORG: Chengdu Institute of Radio Engineering

TITLE: "Study of Compact Resonance Cavity for Hydrogen Maser"

TEXT OF ENGLISH ABSTRACT: A theoretical and experimental study is conducted
for the compact resonance cavity for a hydrogen maser. The variation method
is used to calculate the upper and lower limits of cut-off wave numbers in
circular wave guides loaded with metallic sheets, yielding f_0, Q_0 and η'
of loaded circular cavities. The calculation results found are quite
consistent with the experimental ones, and hence are useful in cavity design.
Some of the conclusions obtained are different from those of other authors.
(Paper was received in October 1983 and finalized in November 1984.)

AUTHOR: JIANG Xiangqi [1203 4382 4388]
          KATO Takeo [0502 5671 7127 3948]

ORG: JIANG of Fudan University, Shanghai; KATO of Anelva Corporation,
Tokyo, Japan

TITLE: "The Fabrication and Characteristics of Ta_2N Field Emitters"

TEXT OF ENGLISH ABSTRACT: Tantalum nitride field emitters are fabricated
by nitrifying a tantalum tip, giving an electron emission current of 210 μA
at the tip voltage of 6.8 kV and a temperature of 1300°C, with a brightness
of 2 x 10^8 A/$cm^2 \cdot$ str and an angular current density of 5 x 10^3 μA/str. The
current fluctuation is small at a pressure of 10^{-8} Torr. Typical field
emission patterns are presented with a dark region at the center and two
symmetrical bright regions on both sides. The composition of tip surfaces
is analyzed by a scanning Auger microprobe. (Paper was received in
February 1984 and finalized in August 1984.)

AUTHOR: JIN Qi [2516 3823]
          WU Xianping [0702 2009 1627]

ORG: Fudan University, Shanghai

TITLE: "The Effects of Si_3N_4 Film on IC Transistors"

TEXT OF ENGLISH ABSTRACT: The effects of Si_3N_4 film on the current gain of
npn and pnp transistors are investigated for different film thicknesses and
deposition processes. The conditions for maximum current gain improvement
are observed. Flatness measurements and the measurements of minority
carrier lifetimes show that the conditions for maximum current gain
improvement correspond to the best stress compensation and the highest
minority carrier lifetime. (Paper was received in December 1983 and
finalized in September 1984.)

AUTHOR: JIANG Mingde [3068 2494 1795]

ORG: Chengdu Institute of Radio Engineering

TITLE: "Representation of the Network of Nestable Concurrent Software
Machines in the Functional Programming System"

TEXT OF ENGLISH ABSTRACT: In order to adapt the functional programming (FP)
system to the environment of distributed processing, a communication
functional form is introduced. On this basis the concept of a concurrent
software machine (CSM) is introduced, which is represented as a module
(i.e., a function) in the FP system. CSM as a function may be nested and
recursive. A CSM network can be formed in which the components communicate
with one another via message-passing functions generated by the communication
functional forms. (Paper was received in June 1983 and finalized in January
1985.)

AUTHOR: LIU Baiyong [0491 4102 0516]
          ZHENG Xueren [6774 1331 0088]
          HUANG Zhaojun [7806 0340 0193]
          et al.

ORG: South China Institute of Technology

TITLE: "Implementation of Three Valued Logic Threshold Gates and T Gate Integrated Circuits"

TEXT OF ENGLISH ABSTRACT: A new three-valued logic (TVL) threshold gate circuit, simple in structure and suitable for IC manufacturing, is described. A three-valued T gate IC for multiple purposes is designed. Their logic operating patterns are given and the transient response characteristics of the linear AND-OR gates operating in TVL are analyzed. The results show that the multicell-type logic (DYL) circuit structure proposed in China is also very promising for implementation of multivalued IC's. (Paper was received in November 1983 and finalized in June 1984.)

AUTHOR: YU Xuewu [0060 1331 2976]
          YUAN Baozong [5913 0202 1350]

ORG: Research Institute of Information Science, Northern Jiaotong
University, Beijing

TITLE: "The Pseudo-Bayes Estimation Method for Extracting Speech Signals
from Noise"

TEXT OF ENGLISH ABSTRACT: The maximum likelihood envelope estimation method
for extracting speech signals from a noisy environment is described. Some
modifications are made. With regard to the statistical characteristics
of speech, the extension of the method leads to an alternative method--
the Pseudo-Bayes envelope estimation method. Extensive testing shows that
the noise can be made imperceptible for the background noise at a S/N ratio
of -5dB. The coherent coefficient is used for evaluating the quality of
extracted speech. (Paper was received in September 1983 and finalized in
April 1984.)

AUTHOR: LIN Yulao [2651 3768 5071]

ORG: Hangzhou Institute of Electronic Engineering

TITLE: "A Phase-locked Loop Using Feed Forward Control"

TEXT OF ENGLISH ABSTRACT: A method for complex control of a phase-locked
loop is presented. Theoretical analysis shows some desirable properties.
This method improves not only the working precision, but also the acquisition
properties, without affecting the loop stability. The possibility for using
this kind of phase-locked loop under noise interference and the problems of
filter design are discussed. (Paper was received in February 1983 and
finalized in November 1984.)

AUTHOR: ZHANG Yifeng [1728 4135 7685]

ORG: Northwest Electronic Equipment Research Institute

TITLE: "GTD Analysis of the Radiation Pattern of a Shaped Subreflector with a Conical Flange"

TEXT OF ENGLISH ABSTRACT: The geometrical theory of diffraction (GTD) is used to analyze the principal plane far-field radiation patterns of a shaped sub-reflector with a conical flange attachment fed by primary feed located at its caustic region. The nonaxial diffraction field and the diffraction field in its axial caustic region are evaluated. In addition to the geometrical optics field from the shaped subreflector and its flange, the diffractions from the wedge formed between the shaped subreflector and the conical flange as well as those of the flange edge are considered. The principal radius of the curvature of the subreflector surface is determined. The computational results show good agreement with those of experiments. (Paper was received in December 1983 and finalized in July 1984.)

9717
CSO: 4009/1098

Electronics

AUTHORS: WU Xunwei   [0702 6064 1218]
             CHEN Jiexiong [7115 0253 7160]

ORG: Hangzhou University

TITLE: "Design of General Sequential Circuits by Using MSI Sequential
             Elements"

SOURCE: Hangzhou HANGZHOU DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF
             HANGZHOU UNIVERSITY (NATURAL SCIENCES EDITION)] in Chinese Vol 12
             No 3, Jul 85 pp 337-348

ABSTRACT: This paper proposes that a MSI sequential element which is
synchronously excitable may be used as complicated memory element with multi-
function. The next state equations and excitation tables of a counter-type
MSI and a register-type MSI are presented. Furthermore, through a design
example, the rules of state assignment and the design procedures by the use
of these two MSI sequential elements are proposed here. The discussion shows
this design method is essentially equivalent to a sequential modification to
the basic sequence of a special MSI sequential element. (Paper received
30 October 1984)

AUTHOR: TANG Tang [0781 2768]

ORG: None

TITLE: "Microcomputer Realization in Retrieval of Chinese Character Font"

SOURCE: Nanjing NANJING DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF NANJING UNIVERSITY (NATURAL SCIENCES EDITION)] in Chinese No 1, Jan 84 pp 109-114

ABSTRACT: In searching for a Chinese character (with a microcomputer), its code and address should be obtained. The author proposes a method of setting up a multilevel data table for retrieving Chinese characters in a microcomputer. Each character is coded into (as long as) four English letters; the first digit should stand for an English letter and blanks may be inserted into the second, third and fourth digits. In the case of a blank in the third digit, the fourth digit has to be a blank. For convenience in usage, codes of more frequently used characters are represented by one to three English letters with a blank(s) filled to complete the four digits. The hardware used is a microcomputer with an 8080 or a Z-80 CPU. The file consists of frequently- and infrequently-used (character) subfiles. With a usage frequency of 99.96 percent, the 4,000-character first subfile is stored in EPROM (Erasable Programmable Ready Only Memory); the 4,000-character second subfile is stored in FD (File Description). In this arrangement, the search space can be compacted, the search rate can be increased, and the internal memory can be reduced. With a file of 8,000 Chinese characters, the overall length of multilevel data table is about 8 K. The search program is about 0.5 K. Therefore, the entire search software occupies about 8.5 K of internal memory, approximately equivalent to the internal memory capacity occupied by the CP/M of a microcomputer operating system. One table shows a coding statistical table for 5,000 characters, based on UYBX BIANMA SHOUCE [UYBX CODING HANDBOOK] by Guo Xuzhen [6753 0650 3791] et al. The author expresses his gratitude to Xu Huanling [1776 3562 0081] of Plant No 734, and Li Haoju [2621 1170 3818] of Computer Science Department, Nanjing University for their assistance.

10424
CSO: 4009/1107

AUTHOR: WANG Yongcheng [3769 3057 2052]
        XIAO Weiying [5618 3837 3841]

ORG: None

TITLE: "Autoindex on Chinese Document Title With Automatic Searching of Words"

ABSTRACT: Wang Yongcheng, one of the authors, presented computational methods and detailed flowcharts on the autoindexing of document titles (western languages) in one paper and one book as follows: Autoindexing Document Title in Western Languages, NANJING DAXUE XUEBAO, No 2 (1983) and QINGBAO JIANSUO ZIDONGHUA JICHU [FUNDAMENTALS OF AUTOMATION IN INFORMATION RETRIEVAL], Zhishi (Knowledge) Publishing House, Shanghai (1982, 11). Basically, nonessential function words like particles and conjunctions are removed from the title; the important words are then lifted out and arranged alphabetically beside the original title. This is the index on document title in western languages. However, the Chinese language is quite unique, not amenable to the above-mentioned procedure. The authors propose to compile two glossaries: one-charter and two-charter (Chinese) words. The vast majority of multiple-character words are assemblage of one- and two-character words, as in the following example: "Electronic Computer" (or just "Computer") can be translated into five Chinese characters of 2 two-character and 1 one-character words--dian-zi [7193 1311] (meaning "electron") ji-suan [6060 4615] (meaning "computation") ji [2894] (meaning "machine"). The authors call these glossaries as "component glossary." In this way, the size of the glossary can be reduced while providing flexibility. This is essentially the autoindexing method for Chinese document titles in solving the problem (to a certain extent) of autodividing Chinese words.

10424
CSO: 4009/1107

AUTHOR: ZHANG Xinger [1728 1630 0348]
ZHOU Wenda [0719 2492 6671]
YE Ni [5509 1200]
ZHU Jiang [2612 3068]

ORG: None

TITLE: "On Design and Implementation of a High Quality Input/Output Element"

SOURCE: Nanjing NANJING DAXUE XUEBAO (ZIRAN KEXUE BAN) [JOURNAL OF NANJING UNIVERSITY (NATURAL SCIENCES EDITION)] in Chinese No 1, Jan 84 pp 115-120

ABSTRACT: This paper presents the design and implementation of an input/output element for a high-level program language XCY-2. The scheme was tested on an IBM 360 computer at computer center of Nanjing University; this version is suitable for complicated data structure. Comprehensive, rigorous compatibility checking is carried out between the type and format of input-output data at the time of compilation. Facilities such as array slicing are provided for structured data. The corresponding object code is compact and efficient, occupying a smaller memory space. The scheme is acceptable because it conforms to the high-quality standard for implementing input-output execution. The authors express their gratitude to Chen Daoxu [7115 6670 5552] and Gui Benxin [2710 2609 2450] for assistance, and to the (Nanjing) university computer center for their support.

10424
CSO: 4009/1107

AUTHOR: SHAO Pinhong [6730 0756 3163]
FU Dalin [0102 1129 2651]
ZHANG Wei [1728 5524]
LI Mingxia [2621 2494 7209]

ORG: None

TITLE: "A Model of Information Request Based on Fuzzy Sets and its Realization"

ABSTRACT: In this paper, the authors present a model of an information retrieval scheme which is based on fuzzy sets and searches documents via an n-level word connecting matrix. The fuzzy information retrieval system (FIRS) operates on a DJS1153 computer; execution of the search program is presented as it occurred in May 1983. The program was written in MBASIC language. File number, key words and the corresponding related coefficient are inputted, and stored in the computer in disk file. Multiple fuzzy matrices can be established so that each matrix corresponds to one document type. Any matrix can be expanded. Two figures show flowcharts for the input and search of information files. References are presented in the following:

1. Shao Pinhong and Fu Dalin, Exploring Information Retrieval Schemes, JISUANJI YU TUSHUGUAN [COMPUTER AND LIBRARY], 1 (1983).

2. Rong Xing [2051 5887], Fang Zheng [2455 2973] and Fu Jianwang [4569 6015 2598], SJTU Science and Technology Information Retrieval System, JISUANJI YU TUSHUGUAN, 2 (1981).

3. Wang Yongcheng [3769 3057 2052], Quasi-Natural Information Retrieval Computation Method, NANJING DAXUE XUEBAO (ZIRAN KEXUE BAN), 1 (1982).

4. He Zhongxiong [6320 0112 7160], Fuzzy Mathematics and its Applications, Tianjin Science and Technology Publishing House, 1 (1983).

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6. L. A. Zadeh, Fuzzy Sets, INFORMATION AND CONTROLS (1965), pp 338-353.

Lasers

AUTHORS: MU Guorong   [4476 0948 5816]
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TITLE: "Determination of the Activity of Catalyst by Laser Method"

ABSTRACT:

The dissociation of CF_2HCl and the formation of C_2F_4 on the surface of Pt, Ag and Ni-Cr catalysts have been investigated by irradiation with different power of CW CO_2 laser. The surface temperature of the catalysts is measured with thermal couple. The laser method used here refrains thoroughly from both the heterogeneous reaction caused by the wall of reactor and the homogeneous reaction aroused by the reactant itself, but they can not be avoided in the conventional thermal method. The results obtained by this method reflect the reactions really taken place on the catalyst surface. So it provides a new, simple and convenient method for the selection of industrial catalyst.

Experimental results show that CF_2HCl dissociation reaction on Pt, Ag and Ni-Cr irradiated with CW CO_2 laser are all first order in a short time at the beginning. The main products before C_2F_4 reaches its maximum yield are C_2F_4 and HCl. From the experimental results, it is concluded that Pt catalyst is more suitable for the pyrolysis of CF_2HCl to produce C_2F_4, while Ni-Cr is not as good as Pt and Ag.
(Paper received 16 November 1983.)

Mathematics

AUTHOR: YE Biquan [0673 4310 0356]

ORG: Wuhan University

TITLE: "Some Technique To Solve Large Symmetric But Nonpositive Definite
             Equations"

ABSTRACT: To solve symmetric but nonpositive definite linear equations, we
present an elimination method which is called segment by segment and piece by
piece elimination method. It is not limited by the capacity of computer as
LDLT method. This method is more suitable to stress analysis for one kind of
large structures with many branches.

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         ZHANG Yannuo [1728 3601 1226]
         CAI Baoli [5591 1405 4539]
         REN Gaixin [0117 2395 2450]

ORG: GAO and CAI of Molecular Biology Institute, Nankai University;
REN of Biology Department, Nankai University; and ZHANG of Tianjin Medical
College

TITLE: "Detection of Plasmid of Bacillus Sphaericus and Comparison of
its Electrophoric Patterns"

ABSTRACT: A fair number of papers have reported on research into plasmids
in Bacillus sporogenes; plasmids were discovered in Bacillus pumilus,
Basillus subtilis, Bacillus megaterium, Bacillus thuringiensis and Bacillus
sphaericus. In this experiment, 15 strains of Bacillus thuringiensis
and Bacillus sphaericus. In this experiment, 15 strains of Bacillus
sphaericus were examined. Inspired by the relationship between plasmid
and toxin formation in Bacillus thuringiensis, a question naturally arises--
whether or not the toxin in Bacillus sphaericus is also related to the
plasmid. Therefore, the authors applied the revised Kado method to detect
the plasmid DNA of Bacillus sphaericus; a comparison was made of gel
electrophoric patterns of Bacillus sphaericus with and without pathogenicity.
Plasmid DNA was detected in 11 of 15 strains.

A revision of Kado's method includes appropriately increasing the mycelial
concentration, washing the mycelium once with 0.2 M neutral phosphoric
acid as the buffer solution, and 1/2 hour treatment with a bacteriolytic
enzyme. What were obtained were clear electrophoric patterns of plasmid
detection in Bacillus sphaericus. Plasmid patterns of 15 strains are
shown. One table shows the relationship among toxin (to mosquito larvae),
plasmid counts, and relative plasmid sizes in Bacillus sphaericus. The
authors express their gratitude to Professor Jiao Ruishen [3542 3843 6500]
for his counsel.

AUTHOR: SUN Faren [1327 4099 0088]

ORG: Agricultural Research Institute, Tai'an Prefecture, Shandong Province

TITLE: "Pest Viruses in Tai'an Prefecture, Shandong Province"

ABSTRACT: From 1979 to 1982, viruses were isolated from pests injurious
to cereal grains, vegetables and fruit trees. These viruses belong to
subgenus A and B of Baculovirus. Microphotographs show 12 of the 18
viruses isolated as follows: Amsacta lactinea NPV, Psilogramma menephron GV,
Setora postornata NPV and GV, Actias selenningpoana GV, Heliothis assulta
NPV, Pontia daplidice GV, Clanis bilincata tsingtauica NPV, Thosea sinensia
NPV, Papilio xuthus NPV, Plutella xylostella GV, and Cnidocampa flavescens
NPV. Six other viruses not shown are Agrotis ypsilon NPV, Leucoma salicis
NPV, Agrotis segetum GV, Clostera anachoreta GV, Cryptothelea variegata
NPV and Parasa consocia GV.

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AUTHOR: YAN Hua [0917 5478]
          XU Lichun [1776 4539 2504]
          YUAN Yu [5913 7457]
          GU Zhongyi [7357 1813 1355]

ORG: YAN and XU of Microbiology Research and Teaching Laboratory,
Yangzhou Medical College; YUAN and GU of Yangzhou Municipal Infectious
Hospital

TITLE: "Preliminary Study on Promoting Growth of Bacillus Tuberculosis
With Sodium Selenate"

ABSTRACT: Six strains of Bacillus tuberculosis were provided by the
Yangzhou Municipal Infectious Hospital; Sauton's culture medium was used.
In the experimental procedure, the authors observed that the morphological
index tends to decrease gradually with increasing selenate concentration.
This phenomenon is especially pronounced when the concentration is greater
than 20 ug/ml. This is possibly due to the toxicity of highly concentrated
selenate to Bacillus tuberculosis, whose count drops sharply when the
concentration reaches 50 ug/ml. In the authors' opinion, the ideal
concentration is 10 ug/ml for promoting growth of this bacillus; this is
consistent with reports abroad giving values of 5 ug/ml.

The authors will conduct follow-up studies on what culture medium (with
selenate) can promote greater growth of this bacillus, shorten the isolation
time, and raise the clinical isolation rate. Also studied will be the
effect of selenate on other biological features of Bacillus tuberculosis.
Three tables show counts of Bacillus tuberculosis in each field of vision,
variance analysis on sensitivities of different strains to selenate, as
well as comparisons (between two strains) of average counts.

AUTHOR: LIANG Linuo [2733 7787 4754]
          YUAN Jisheng [7086 4949 3932]
          YAN Xunchu [7051 6676 0443]

ORG: All of Microbiology Institute, Chinese Academy of Sciences

TITLE: "Methods for Isolation and Rapid Identification of Mycobacterium"

ABSTRACT: Isolation and rapid identification of Mycobacterium is not
only an important problem in the classification of Actinomyces, but also
can provide a criterion for the clinical diagnosis of non-typical diseases
due to Mycobacterium. By using a chemical method, Kanetsuna et al.
rapidly discriminated Mycobacterium from Nocardia; however, their study
was limited only to known strains. By using Kanetsuna's method, the authors
isolated, purified and analyzed Mycobacterium acid of 30 unknown Bacillus
acidoresistant, two known Mycobacterium (M. smegmatis and M. fortuitum),
and two Norcardia (N. asteroides and Norcardia A30) strains. Mycobacterium
acid was extracted from these strains; the results (as shown in one of
two tables) are consistent with those of Kanetsuna et al. These 30 unknown
strains have been identified as Mycobacterium. The other table lists the
bacteria counts in soil samples. Besides soil samples in China, other
experiments were conducted at Cornell University. The authors express
their gratitude to Liu Zhiheng [0491 1807 1854] for his assistance.

10424
CSO: 4009/2006

AUTHOR: WEN Yuwen [2429 1785 7186]

ORG: None

TITLE: "Automatic Position Control System of the Refuelling Machine for Qinshan Nuclear Power Plant"

TEXT OF ENGLISH ABSTRACT: This paper describes the automatic position control system designed for the refuelling machine of Qinshan Nuclear Power Plant. In order to accomplish accurate positioning, a numerical control system including a step-motordrive unit is used. The performance test of this control apparatus is done on the model machine and the results are in conformity with design specifications.

AUTHOR: YU Shicheng [0151 0013 6134]

ORG: None

TITLE: "Methyl Iodide in Radioactive Waste Gas of Nuclear Power Station"

TEXT OF ENGLISH ABSTRACT: Under nuclear power station accident conditions, fission product iodine or its compounds can be released and most of them can be converted to organic iodide, mainly methyl iodide. The data on the percentage of the fission product iodine converted to methyl iodide are quite scattered, from less than 1 percent to over 20 percent, and determined by the operation power of the nuclear power station and the chemical condition in the environment. More methyl iodide formation occurs from oxide fuel than from metal fuel. The absorption by the activated charcoal of impregnation is the method frequently used to trap organic radioiodine species. The widely used impregnants are potassium iodide and triethylenediamine.

AUTHOR: LIU Hanxun [0491 3352 8113]

ORG: None

TITLE: "Water-hammer Experimental Set-up and Water-hammer Experimental Study for New Types of Check Valve Applied to PWR"

TEXT OF ENGLISH ABSTRACT: This paper describes a self-designed constant temperature water-hammer shock test rig with stainless steel loop in which deionized water is used as working medium. To conduct water-hammer shock simulation tests for the countercurrent phenomenon occurred in the process of shutting, stopping, parallelling and switching the coolant loops of nuclear reactor, a specially designed four-way switching valve and its pneumatic mechanism are used. Water-hammer experimental study is performed for two types of PWR's nonshock check valve with diameters of 150mm and 200mm simultaneously. Transient performance of the shock waves, magnitude of their peaks and durations of their fluctuation, are obtained. Some analyses for existing calculational method on water-hammer are made.

AUTHOR: ZHANG Shougang [1728 1343 4854]

ORG: None

TITLE: "Production of Radioisotopes with HFETR"

TEXT OF ENGLISH ABSTRACT: Production of radioisotopes with HFETR is a possible way to raise the yield and improve the quality of the product. In this paper the problems that care must be taken in target irradiation and the fundamental technological processes for production of high radioactivity ^{60}Co teletherapy source, ^{60}Co source for brachytherapy and ^{113m}In generator are examined. Some suggestions that reduce production cost are presented.

AUTHOR: HONG Yonghan [3163 3057 3352]
         YAN Zhe [7051 0772]
         LI Maolin [2621 5399 2651]
         et al.

ORG: None

TITLE: "Determination for Threshold Value of Failed Fuel Element Detection in HFETR"

TEXT OF ENGLISH ABSTRACT: In HFETR, the measurement of delayed neutron and γ-ray is taken as a method of failed fuel element detection. This paper describes the failing test of the fuel element cladding, the release way for fission products from failed fuel and the calculation of its activity in reactor coolant and provides a lot of monitor data about coolant activities under normal operation.

According to the analysis mentioned above, the detection threshold of failed fuel element is determinated by what has been used in the monitor.

AUTHOR: TIAN Hechun [3944 0735 2504]
        LEI Lixing [7191 4539 1800]

ORG: None

TITLE: "The Reactivity Effect of Fission Products and Equivalent Methods of Imaginary Fission Products in a Highly Enriched Uranium FTR"

TEXT OF ENGLISH ABSTRACT: In this paper, using the approximate method to calculate the burnup of a highly enriched uranium FTR, the heterogeneous depletions of 230 fission products are calculated. According to the reactivity effect of fission products, three equivalent methods are studied, in which a few were imaginary fission products. In this method the maximum error of the reactivity effect process is only about 2 percent in the whole burnup.

12949
CSO: 4009/293

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Physical Chemistry

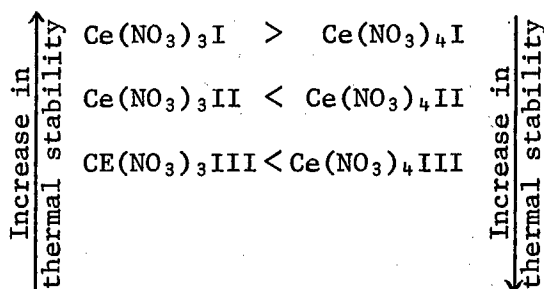AUTHORS: WANG Jingqiu   [3769 7234 4428]
            XIAO Wenjin   [5135 2429 6930]
            ZHONG Jiacheng [6988 1367 2906]
            XU Hong   [1776 4767]
            HU Guiduan
            NI Xiaoling

ORG: Wuhan University

TITLE: "Studies on Rare-Earth Complexes of Crown Ethers: V. The Syntheses
            and Properties of the Cerium (IV) and Some Rare-Earth (III) Nitrate
            (Perchlorate) Complexes With the 18-crown-6 Ether and Dibenzo-18-
            crown-6 Ether"

ABSTRACT: Eight complexes of cerium (IV) and some rare-earth (III) nitrates
(perchlorates) with 18-crown-6 ether (I) and dibenzo-18-crown-6 ether (II)
have been prepared in methyl-cyanide. The results of their elemental analysis,
molar conductance, infrared spectrum, ultraviolet spectrum, differential
thermal analysis and thermogravimetry are discussed: (1) The nitrates com-
plexes are nonelectrolytes and perchlorates complexes are electrolytes in
methyl-cyanide. (2) The coordination number of each metal ion is about 9 or
more. (3) The chemical formulas of these complexes are $LnA_{3(4)}$ I x H_2O (Ln=
Ce (IV), Y; A=ClO_4^- or NO_3^-; x=0,3,4.) and $LnA_{3(4)}$ II x H_2O (Ln=Ce (IV), Gd, Eu,
Y; x=0,1,3,.) respectively. Besides the characteristics of thermal stability
of $Ce(NO_3)_{3(4)}$ I, $Ce(NO_3)_{3(4)}$ II, $Ce(NO_3)_{3(4)}$ III were discussed in particular.
The rules of thermal stability of them are as follows:

$$
\begin{array}{c}
\text{Ce(NO}_3)_3\text{I} \;>\; \text{Ce(NO}_3)_4\text{I} \\[4pt]
\text{Ce(NO}_3)_3\text{II} \;<\; \text{Ce(NO}_3)_4\text{II} \\[4pt]
\text{CE(NO}_3)_3\text{III} \;<\; \text{Ce(NO}_3)_4\text{III}
\end{array}
$$

(left: Increase in thermal stability ↑; right: Increase in thermal stability ↓)

CSO: 4009/1124

Physical Chemistry

AUTHORS: LIU Yingjun   [0491 5391 7486]
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ORG: Institute of Physical Chemistry, Beijing University; project
            supported by the Science Fund of the Chinese Academy of Sciences

TITLE: "Studies of the Interaction Between MoO_3 and Various Carriers and
            Determination of the Monolayer Dispersion Capacities of MoO_3"

ABSTRACT: The systems of MoO_3/TiO_2, MoO_3/SiO_2 and MoO_3/MgO, by mixing crystal-line MoO_3 with one of these carriers respectively and then being calcined at appropriate temperature, have been studied by x-ray diffraction. The results show that MoO_3 disperses on titania surface as a close-packed monolayer, the experimental maximum dispersion capacity (the threshold value) of MoO_3 on titania surface is 0.12g $MoO_3/100m^2$ (i.e. 4.9×10^{18} Mo atoms/m^2, see Figs. 1,2), which agrees with the calculated value according to a close-packed monolayer model, as in the case of $MoO_3/\gamma-Al_2O_3$ system. The experiments also show MoO_3 disperses on silica surface as a monolayer but not a close-packed one, its monolayer dispersion capacity is 0.032g $MoO_3/100m^2$ (i.e. 1.4×10^{18} Mo atoms/m^2) corresponding to a coverage $\theta = 0.27$ (see Figs. 3-5). For MoO_3/MgO system, the experiments show that a solid reaction between MoO_3 and MgO occurs at 290°C to form $MgMoO_4$ to some extent instead of a monolayer dispersion (see Fig. 7). All these systems with the addition of $MoO_3/\gamma-Al_2O_3$ system have been compared (see Table 1) and discussed based on the acid-base properties of carriers, their chemical bonds and their structures. MgO, an oxide of ionic bond and rather stronger basicity, reacts with MoO_3 forming a bulk com-pound $MgMoO_4$. However, it is not easy for SiO_2, of covalent bond and non-metallic oxide property, to carry out a reaction with MoO_3. Both of $\gamma-Al_2O_3$ and TiO_2 are in the intermediate case, therefore MoO_3 can disperse on them as close-packed monolayers. (Paper received 19 September 1983)

CSO: 4009/1129

Semiconductors

AUTHORS: ZHANG Xiumiao [1728 4423 8693]
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ORG: Hangzhou University, Class of 80

TITLE: "Determination of Generation Lifetime and Surface Generation
            Velocity from I-C Measurement of Pulsed MOS Structure"

ABSTRACT: Based on Rabbani's model, here is reported the method of using I-C
transient response curve to a step voltage for a MOS capacitor to determine
the bulk generation lifetime and the surface generation velocity. Neither the
slope of the transient curve nor the doping concentration of substrate is
required; therefore, the calculation is much simpler and the error of measure-
ment can be reduced. This method is also suitable for measuring those samples
with nonuniform doping concentration. (Papers received 3 September 1984.)

CSO: 4009/1126   END